


# THE AGATES OF NORTH AMERICA

Published by  
The Lapidary Journal

Price \$2.00





Digitized by the Internet Archive  
in 2022 with funding from  
Kahle/Austin Foundation







# **THE AGATES OF NORTH AMERICA**

**Compiled and Edited by  
Hugh Leiper, F.G.A.**

**THE LAPIDARY JOURNAL, Publisher,  
3564 Kettner Blvd., San Diego, California 92112  
P.O. Box 2369**



Copyright, 1966, by  
LAPIDARY JOURNAL, INC.

*No reproduction in any form of this book, in whole or in part (except  
for brief quotation in critical articles or reviews), may be made  
without written authorization from the publishers.*

*Revised Edition, 1966*

*Fifth Printing*

PRINTED IN THE UNITED STATES OF AMERICA

Arts & Crafts Press,  
San Diego, Calif.



# THE AGATES OF NORTH AMERICA

## TABLE OF CONTENTS

	Page
What Do We Really Know About The Formation Of AGATE AND CHALCEDONY?, by John Sinkankas, C.G. - -	6
HOW TO HAVE SUCCESSFUL FIELD TRIPS, by June Culp Zeitner - - - - -	11
WHY NOT USE AN AGATE LOCATOR?, by Ken Kyte - - - - -	12
AGATE VARIETIES OF THE PACIFIC NORTHWEST, by Clyde L. Browning - - - - -	15
OREGON'S AGATE BEACHES, by Clyde L. Browning - - - - -	18
THE OLD AND NEW AGATE BEDS AROUND PRINEVILLE, OREGON, by Dorothy Ashby - - - - -	20
IDAHO'S DESERT CANYONS FOR BRUNEAU JASPER, by "Snake River Pete" - - - - -	22
MONTANA AGATE—A Most Fascinating Gemstone, by Bert C. and C. M. Pederson - - - - -	24
ABOUT MONTANA AGATE, by James J. Kehoe - - - - -	25
VARIED AGATE TYPES AND LOCATIONS IN CALIFORNIA, by Loran E. Perry - - - - -	28
AGATE IN ARIZONA, by Floyd Getsinger - - - - -	31
HOW I CARVE RARE FIRE AGATE, by Olive M. Colhour - - - - -	34
AGATE, JASPER AND WOOD In The Land Of Enchantment, by Merrill O. Murphy - - - - -	38
Some Of The Beautiful Varieties Of AGATE IN TEXAS, by Hugh Leiper, F.G.A. - - - - -	43
WE FOUND THE END OF THE RAINBOW, by Mellie and Mel Ehresman - - - - -	45
CAN YOU TOP THIS—1600 Pound Canadian Agate - - - - -	47
CENTER COLOR SPREAD—"THE AGATES OF NORTH AMERICA" - - - - -	48-49
Key to Color Spread - - - - -	50-51
EASY WAYS TO COLOR AGATE, by Melvin L. Kathan - - - - -	51
THE AGATES OF THE CENTRAL SOUTH, by Ken Kyte - - - - -	52
AGATE IN THE SOUTHEASTERN STATES, by Henry B. Graves - - - - -	55
HOW TO CUT AGATIZED CORAL, by June Culp Zeitner - - - - -	55
AGATES OF THE ROCKY MOUNTAIN EASTERN SLOPE, by June Culp Zeitner - - - - -	57
THE AGATES OF UTAH, by Glenn C. Osborne - - - - -	60
WHERE TO GO IN UTAH, by Albert L. Hubert - - - - -	61
A BEAUTIFUL WYOMING AGATE, by Wayne R. Breitweiser - - - - -	63
THE FAIRBURN AGATES, by Jack Zasadil - - - - -	64
HOW TO CUT FAIRBURN AGATES, by June Culp Zeitner - - - - -	64
IRIS AGATE And Its Treatment, by Erna Clark - - - - -	66
FIRE AGATE OF CALIFORNIA, by Joseph W. Baker - - - - -	68
GOLD IN QUARTZ, by Clyde L. Browning - - - - -	69
LAKE SUPERIOR AGATES Are In A Class By Themselves, by J. Lester Cunningham - - - - -	70
The Colorful Agates Of NORTHERN MEXICO, by Wm. J. Lyons and Jack R. Young - - - - -	78
NOVA SCOTIA AGATES, by Wm. F. Take - - - - -	80
ROCKHOUDING IN THE PRINCE GEORGE AREA—BRITISH COLUMBIA, by Art Bell - - - - -	82
THE OMINECA AGATE STORY, by Art Bell - - - - -	82
COLLECTING IN COLORFUL COLORADO, by Byron H. Rohde - - - - -	85
GUIDE TO THE AGATE FIELDS OF BEDFORD CO., TENNESSEE, by Virgil S. Owens - - - - -	89
THE CASTLE DOME FIRE AGATE FIELD, by Oscar L. Brauer - - - - -	92
SOLIDLY FILLED AGATIZED CORAL FOUND IN NEW FLORIDA LOCATION, by Herman W. Hollingsworth - - - - -	94
NEW FIND OF AGATE THUNDER-EGGS MADE In British Columbia, by Mrs. Fred Frese - - - - -	95



# What do we really know about the formation of AGATE and CHALCEDONY?

By John Sinkankas, C. G.

Author of "GEMSTONES OF NORTH AMERICA," "GEM CUTTING — A LAPIDARY'S MANUAL" and "GEMSTONES AND MINERALS — How and Where To Find Them."

## Introduction.

Among some of the very wealthy it is fashionable not to acknowledge the existence of gemstones other than the traditional diamond, ruby, emerald, sapphire and pearl. Yet what person with a true sense of beauty and appreciation of the marvelous works of nature can resist admiring the intricate patterns of a splendid moss agate—green, brown, red, or black gossamer threads against translucent chalcedony? Or the striking color bands of Mexican agate? Or even the more drab-colored but interesting patterns of turritella shells forever preserved in imperishable silica? Surely only the blind can condemn agate and its many chalcedony cousins.

In this connection it is to be noted that the humble agate has been eagerly sought since time immemorial and lovingly fabricated into all kinds of gems and ornamental objects. The Greeks and Romans appreciated its fine grain which allowed the most delicately chiseled likenesses of persons to be engraved in ring and brooch stones. The courtiers of France's King Louis fastidiously dipped snuff from elegant little gold boxes whose panels were made of especially fine agate, while Faberge, the fabulous jeweler for an even more fabulous Tsarist court, leaned heavily on a number of chalcedony varieties to provide raw material for the expensive baubles and carvings he turned out in such profusion. No, there is nothing to be ashamed of in liking agate and nothing to apologize for. Though gratifyingly common, it is no more to be rejected than the colorful wildflowers which we admire in the field and have made captives for our own gardens.

To properly appreciate agate, or really, I should say, *chalcedony*, which is the correct term to use for the basic material of agate and other varieties of this form of quartz, we should know something about its composition and structure. This in turn will make better judgment possible of what is good in agate and what is bad. It will help also to understand why its patterns and colors form as they do.

First of all, *chalcedony* is a kind of quartz, but in a vastly different form

from the ordinary crystalline variety. Although it is composed of slender fiber-like crystals, these are so small that billions fit into a mass the size of a hazelnut. Needless to say, you cannot see them, even with a high-powered optical microscope, and it is only lately that a good idea of the structure of these peculiar masses has been obtained by examining specimens under electron microscopes which magnify details tremendously. For example, Folk & Weaver (1952) found that chalcedony really consists of fibrous crystals of quartz with very small spaces between, usually filled with *water*, and *not* opal as was once thought! The lower refractive index and specific gravity of water, not to mention the possibility that considerable air could be filling spaces, accounts for the lower properties of natural chalcedony as compared to ordinary quartz:

	Quartz	Natural Chalcedony
Refractive indexes	1.544	1.533
	1.553	1.539
Specific gravity	2.651	2.58 - 2.64

Incidentally it is this superfine structure of chalcedony which makes it handle so well during cutting and polishing. It is extremely tough, hard to break (who hasn't bounced a hammer from a piece of chalcedony?—and without effect?), and takes a superb polish with reasonable care in preliminary work. Lately more and more amateurs are turning toward chalcedony for carving work, finding it among the best gemstone materials for just the reasons mentioned.

## Nomenclature.

Earlier, I mentioned that chalcedony is the name of the basic material of agate and other varieties, which most of us tend to lump together simply as "agate." Yet we do need a little discrimination in the matter of names, especially during these days when our hobby is growing by leaps and bounds, and many more sources of chalcedony gemstones are being turned up. *Chalcedony* is the accepted name for the special kind of quartz we are dealing with and this is what we should use when we speak of the material itself.

As to other names, they are all variety names and most attempt to describe what the variety is either on the basis of color, pattern or inclusions. For example, agate is classically reserved for banded chalcedony with sometimes other names being used to further describe specific types, e.g., *fortification* agate where the bandings make sharp turns which resemble the angular parapets and redoubts of old-fashioned fortresses. However, other words are also used which though very descriptive, get away from the idea of banding, e.g., *moss* agate, *cloud* agate, *polka-dot* agate, etc. Most of these are so firmly fixed in the minds of collectors and cutters, not to mention authors, that it is probably best that they remain the way they are. Properly, most moss agates should be called *moss chalcedony* since the best types seldom show decided bandings.

As a word of advice to those who find chalcedony varieties which they believe to be sufficiently different to call for a special name, do not be tempted to put a personal name on them such as *jonesite* or *smithite* since this causes no end of confusion with minerals which are now officially labeled with an "-ite" on the end, usually in honor of a deserving person who is distinguished in some way in the fields of mineralogy or geology. I think it far better to label the new material with a descriptive title rather than a personal name, for example, there is no objection to Crater Lake jasper, or Dryhead agate, or San Rafael wood, or even such colorful yet descriptive terms as flowering obsidian.

## Research On The Formation of Chalcedony.

The most casual glance at a lump of chalcedony placed side by side with a mass of ordinary crystalline quartz is enough to show the least expert person the great differences between them. For centuries chalcedony was not even suspected of being the same mineral, but as the science of mineralogy grew its identity was at length established. However, many questions remained unanswered and consequently the "whys" and "hows" of chalcedony have received the



on-and-off attention of many amateurs and professional mineralogists for over a hundred years. The Germans, especially those interested in improving the knowledge of native gem-cutters in Idar/Oberstein, known for centuries for their skill in treating chalcedony, were intensely interested in determining the true nature of chalcedony and explaining its modes of formation. In the United States, even though chalcedony gemstones are produced in much greater amount than any other kind of gemstones, and the direct and indirect dollar volume of business is really a very large sum, few professional mineralogists or geologists have done more than offer off-the-cuff opinions backed up by very little scientific effort to find the answers which have been eluding us for all these years. Happily, recent investigations particularly in the field of quartz crystal growth, and even more recently in the making of artificial chalcedony, promise to shed more light on this common yet puzzling gemstone material.

The best summary of chalcedony investigations that I know of, is, regrettably for English-speaking persons, written in the German language by Dr. Ing. Walther Fischer (1954). This lengthy article is illustrated by several splendid photos of agate and chalcedony selected to illustrate the ideas of Dr. Fischer in respect to the formation of chalcedony in nodules. Much of the brief historical sketch given is taken from this article.

One of the first milestones in chalcedony research was the publication of *Die Achate* (1915) by R. E. Liesegang. In this book Liesegang stated his idea that agate banding was due to the formation of colored "rings" in jelly-like masses of chalcedony filling openings in rock, the coloring matter coming from the walls of the cavities and creeping through the still soft material. Later the jelly-like masses of silica were supposed to harden into the banded agate nodules with which we are so familiar. Liesegang came to this conclusion through laboratory experiments using various dyes in gelatin solutions. Reis (1916-1920) and von Freyberg (1927) objected to Liesegang's theory and pointed out many reasons why this process could not work. A few years later, Linck & Heinz (1930) restated the very old belief that banding was due to rhythmic deposits of chalcedony from solution rather than by diffusion through a silica gel. Nacken (1948), a learned German scientist, had for some years been experimenting with the growth of quartz and advanced his theory that agate nodules really began as globules of silica glass derived from the separation of molten silica from other constituents in lavas. According to his ideas, the nodules were converted into chalcedony by the action of superheated water such as had been found so effective by him in dissolving and recrystallizing quartz. Schlossmacher (1950), another eminent German mineralogist noted among gem-

ologists for his work in gemstones, carried Nacken's ideas further and expressed the view that quartz crystals found so commonly in the center of agate nodules formed because of the slower cooling of the interiors as compared to the outer portions. This difference in cooling gave time for the silica to grow into large crystals rather than the sub-microscopic crystals of chalcedony. Further, he stated that if the cooling reversed itself for some reason, it was quite possible that alternate bands of chalcedony and quartz could grow, again as commonly seen in many agate nodules.

All of these theories were helpful to some extent but as Dr. Fischer himself put it, they all suffered from the attempt on the part of scientists to explain events in nature from laboratory experiments without taking into consideration what the evidence in the field shows to be the case.

#### *Recent Research.*

As for recent work, some excellent studies have appeared in American professional journals. For example, C. R. Pelto (1956) studied chalcedony and determined that the brownish color of thin slabs held up to the light was due to the scattering of light by many very small spaces between the fibers. Experiments in converting amorphous silica into quartz were undertaken by R. M. Carr & W. S. Fyfe (1958) who confirmed the theory that quartz forms from amorphous silica in steps, passing through several intermediate stages before converting into quartz. They found that pressure had much more to do with making the conversion than temperature.

E. H. Lund (1960) became interested in the formation of silicified corals of Tampa, Florida, and remarked particularly upon a coral geode which contained two distinct cavities, one lined with the usual smooth-surfaced chalcedony but the other with small sparkling quartz crystals. In his article, he cited the work of G. B. Alexander, W. M. Heston & H. K. Iler (1954) on the solubility of silica in water, and the work of K. B. Krauskopf (1956) in the same field. The conclusions reached are important to our understanding of how chalcedony forms because all investigators stated their conviction that silica could dissolve in water under low pressure and low temperature condition without going through a jelly or colloidal stage. According to Lund, these conditions are exactly those under which the corals of Tampa Bay are being converted even now to chalcedony.

#### *The Synthesis of Chalcedony.*

Finally, in our review of modern ideas on the formation of chalcedony, the work of J. F. White and J. F. Corwin (1961) must be mentioned since they achieved spectacular success in synthesizing chalcedony although they credit Nacken with being the first to do so. Their process uses a silver-lined metal

bomb in which rods of silica glass are placed in a slightly alkaline water solution. The bomb is heated to maintain an internal temperature of 400°C, providing a pressure of about 5,000 lbs. per square inch; "runs" of 48 hours in length were made. Glass rods subjected to this treatment were converted into quartz through the following steps:

amorphous silica (glass) →  
cristobalite → keatite →  
chalcedony → quartz

If the process is carried on longer, all of the intermediate phases, including chalcedony, disappear, and nothing but quartz remains. Using the information discovered during their experiments and information from other investigators, they came to valuable conclusions which may be of great help in settling some puzzling questions about how chalcedony forms in nature:

- Natural chalcedony forms near the surface, that is, under conditions of low pressure and temperature.
- Natural chalcedony is commonly associated with amorphous silica (opal) while opal commonly converts into chalcedony.
- Chalcedony forms between the temperatures of 100°C and 300°C, and it is not possible to grow chalcedony below 100°C. Opal is the mineral which forms at the lower temperatures.

In connection with the above conclusions, Fischer (1954) remarks on the conversion of opal into chalcedony and furnishes several photographs to prove the point. However, in respect to temperature of chalcedony formation, the statements of Lund (1960) and others cited by him, indicate that chalcedony *can and does form* at temperatures considerably lower than 100°C.

#### *Chalcedony In Nature.*

Perhaps the most useful information from the above is that chalcedony can dissolve in water even at low temperatures and explains why it is so abundant in sedimentary formations in the form of silicified fossils, petrified wood, or as large masses of chert. On the other hand, the fact that it cannot form at temperatures higher than 300°C also shows that most igneous rocks must have had chalcedony introduced in them *after* they cooled considerably.

In every kind of rock, the question of "where did the silica come from" is a good one to ask, particularly in the case of basalt which is noted for being very poor in quartz as a constituent mineral, yet is often rich in chalcedony in seams, veins, and nodules. Possibly the best explanation of this paradox is that given by W. T. Schaller (1932) who faced the same question when he examined the "traprocks" of New Jersey and had to explain the origin of the many minerals in the cavities, among them much chalcedony and quartz. He believed that the basalts flowed over moisture-laden sedimentary formations, possibly even saltwater swamps or flats, causing the



water beneath to become intensely heated. Naturally this water sought to escape and did so by forcing its way upwards through the basalt cover, filling cracks and crevices with mineral matter on its way through.

In ore veins derived from the escape of similar vapors and waters from deep-seated bodies of igneous rock, chalcedony is only found in uppermost portions for only here were temperatures low enough to permit its formation. At higher temperatures, that is, over 300°C, quartz would form instead. Where veins have been explored to considerable depth it is found that chalcedony disappears and quartz takes its place as we would expect since rocks become hotter as greater depths are reached.

In the case of sedimentary rocks in which enormous quantities of chalcedony often occur, as in the Petrified Forest of Arizona in the sedimentary Chinle formation, or in the beds of chert which outcrop in many places in the limestones underlying much of the Midwestern States, it must be assumed that the silica which furnished the chalcedony must have been present within the formations in the beginning. The Chinle formation, for example, is plentifully supplied with quartz-sand and pebbles, while the limestone formations of saltwater origin, received silica from streams and rivers flowing into ancient seas, much of which was subsequently absorbed by diatoms and other small sea animals to form opal skeletons. Thus a great deal of silica was available for dissolving in water and later conversion to chalcedony.

Of lesser importance but still of great interest to gem cutters are the small deposits of chalcedony which form through the weathering of rocks and minerals near the surface. Chrysoprase, a beautiful green chalcedony colored by minute quantities of garnierite, a silicate of nickel, is found almost exclusively in weathered serpentine rocks but never in great amounts and always near the surface. The basic chalcedony forms from the decomposition of the serpentine when attacked by agents carried by rainwater trickling downward from the surface. If nickel minerals are present, as is often the case in serpentines, ordinary chalcedony and sometimes opal will be handsomely stained and become prized gem materials. In much the same way, the treasured bright blue-green chrysocolla-chalcedony of Arizona forms through the action of surface waters trickling through the upper or "oxidized" portions of copper ore veins or the much larger copper-bearing porphyries which are mined in open-pit style.

#### *The Formation of Agate Nodules.*

Anyone who has examined a variety of agate slices is sure to have seen places where the banding narrows sharply and seems to form "canals" leading from inside the nodule to the outside. Some investigators of agate claim that these canals were once open and mark the

places where silica-bearing solutions gained access to openings in basalt and other volcanic rocks. To them it was easy to see how chalcedony could form along cracks and fissures but it was difficult to understand how a rounded gas cavity in solid rock could be filled with chalcedony if there was no way for the solutions to get in.

This puzzling question is the reason why some early geologists believed that agate nodules could have formed only from solid globules of silica glass as mentioned earlier in this article. However, it is now generally agreed that "solid" rocks are far from being as solid as they seem, and that it is actually easy for water solutions to pass through them via the many small pores which surround the individual crystal grains making up the mass of the rock. Thus silica can pass through "solid" rock and find its way into blind openings such as the gas cavities in which so many agate nodules are formed. As for the "canals," many nodules freshly dug out of basalt show absolutely no trace of chalcedony pipes or canal continuations which lead away from the nodules into the surrounding rock. The quartz crystal geodes of the Midwest are a very common example of blind openings filled with quartz and again show no signs of adjoining pipes or canals through which silica-bearing solutions could have entered.

From the above, the only logical conclusion to draw is that the silica in entering blind cavities in rock, must have seeped in through the walls, probably at a slow rate, depending on how porous the rock happened to be. However, the next question to answer at this point is: "*Why doesn't the cavity fill up with the silica solution and then stop right there?*" Why should it keep attracting more and more silica until it is sometimes filled completely? I cannot answer these questions except to say that the evidence of the nodules themselves shows that they do absorb successive waves of silica solutions as shown by the bandings, and apparently keep right on doing so until no more space is left. If there are no exits to the cavities, except the walls themselves, then the water which brought in the silica must leave by the same route.

As for the passage of silica-bearing solutions through already formed chalcedony, the experiments of White & Corwin (1961) previously cited, show that this does happen since the conversion of silica glass in the interior of the glass rods used in their experiments would not have been possible otherwise. Furthermore, the ability of water to pass through chalcedony and at the same time to carry coloring matter, is well proven by hundreds of years of agate dyeing as still practiced by the lapidaries of Idar-Oberstein.

#### *The Formation of Mossy Growth and Spots in Chalcedony.*

Some of our most fascinating chalced-

ony varieties are those which display spots, veils, plumes, and moss-like filaments of contrasting color seemingly suspended in pools of translucent material. For a great many years, such growths, especially the kinds which look like algae, were actually regarded as petrified vegetable matter. Some very eminent persons, one of whom, a formerly well-known geologist who died not too long ago, held firm to this belief in the face of incontrovertible evidence to the contrary. These views are briefly but clearly explained by R. W. Brown (1957) who carried on the work of his eminent predecessor, the same geologist mentioned, but was forced to conclude his views in error.

As mentioned before, another authority, Liesegang, held the view that silica in solution deposited as a jelly-like mass in cavities before slowly solidifying. According to his ideas on the diffusion of color, and also upon the growth of moss spots and other inclusions in chalcedony, the material within the cavities had to be a jelly and not a solid. Brown (1957) supports his views. To Liesegang, it was inconceivable that such delicate structures as mossy filaments could grow in anything but a supporting medium of sufficient stiffness to hold up the fragile fronds and yet soft enough to grow and push upward from the cavity walls toward the centers. Experiments with laboratory beakers filled with gelatins in which small amounts of minerals placed beforehand in the bottoms caused development of similar growths, led to Liesegang's theory. But again, it was laboratory work carried on without close examination of actual nodule specimens to determine what had really happened in nature.

In attempting to find some answers for myself in respect to the growth of moss and other delicate inclusions in chalcedony, a large number of polished slabs and cabochons of agate, jasper, and other forms of chalcedony, including petrified wood and turritella, were examined using a binocular microscope with 40 power magnifications. Details of growths were made clear enough to reveal some interesting things about coloration as well as about the inclusions themselves.

In respect to solid inclusions, there are several distinct types: (a), sheetlike or tubular growths generally of greenish-gray color; (b), slender black crystals and outgrowths of same in the form of exceedingly thin platelets; (c), minute opaque dots occurring alone or in clusters of various general form, and, (d), opaque inclusions as clots and curds in a variety of colors.

In addition to the above were found acicular needles of some unknown mineral or minerals, slender distorted rhombohedral and normal rhombohedral crystals of calcite, and dark brown curved rhombohedral crystals which may be siderite or possibly some other carbonate. Other inclusions, particularly



in Mexican agate, are angular breccia-like fragments of a soft greasy mineral in a variety of pale color shades which may be an alteration clay mineral such as halloysite. Calcite is abundant along the rims of unweathered nodules and is easily recognized by exhibiting shallow depressions wherever it is polished over and by its softness when scratched with a needle.

Type (a) inclusions are most likely members of the chlorite mineral group which are very common in unfilled basalt cavities where they form dusty or mossy growths on walls of cavities or form ball-like radiate growths with velvety upper surfaces. The color is always some shade of green to blackish-green. Type (a) inclusions are often extremely slender and delicate, and in truth it is difficult to see how they can develop other than in a water solution which provides some support for the fibers. However, contrary to the views of Brown (1957, p. 333), I believe that such fibers did not grow within a jelly-like mass of chalcedony but did grow in a silica-bearing solution. This view is supported by the fact that every specimen examined invariably showed each frond and fiber surrounded by a sheath of chalcedony displaying the typical radiate formation of chalcedony fibers. It is possible that chalcedony needles formed upon the chlorite inclusions as they developed, but certainly it seems impossible for the chalcedony to form first and then be pushed aside by the intruding mossy structures. According to Brown (1957, p. 335-336) the fronds and fibers grew into a jelly of silica as follows:

"During this process, around each filament there was generated a sharply defined field of chemical or electrical influence that not only cleared the immediately surrounding gel but, so to speak, held at arm's length at a fairly uniform distance any suspended globules of mineral matter, thus creating around each filament a transparent halo, the gel outside the halo remaining more or less translucent and, where it contained dark mineral particles, becoming concentrically zoned in the manner of Liesegang rings (Liesegang, 1907). Here, also, the concentricity of the rings was influenced in some way by the presence of the filaments, for the curves of the rings parallel those of the filaments faithfully. It seems clear, therefore, that the filaments originated after and not before the cavity was filled with gel."

Brown then goes on to say that "—some as yet unknown condition initiated the transformation of the soft gel into cryptocrystalline agate and chalcedony, thus embedding the fragile filaments in a hard matrix and preventing their destruction by earth movements."

Brown's ideas are based on the assumption that the entire cavity, or, much of it at least, was filled with silica gel on the verge of solidifying. Yet if such had

been the case, then surely, as the mysterious transformation he speaks of took place, the filaments and other inclusions would be destroyed by the crystal fibers of forming chalcedony. It is also difficult to imagine that a soft and yielding gel, presumably with much water in it to keep it soft, would suddenly harden without considerable shrinkage in volume and the development of many cracks like the "crazing" noted upon pottery glazes or even in many opals which probably were true silica gels at one time. From the evidence offered by hundreds of specimens examined, it appears to me at least, that chalcedony can form from true solution, precipitating directly upon inclusions, or it can also form viscous gel layers, but never of great thickness. The discussion which soon follows on other types of inclusions will show why I believe thin layers of gel possibly form as well as direct precipitation from solution as we know is easily possible from the findings of authorities mentioned earlier (Lund, 1960).

Type (b) inclusions, that is, hosts of tiny black crystals forming plumes, and from them, exceedingly thin platelike growths, are especially characteristic of Woodward Ranch plumes (Texas) and some Oregon plumes. I have seldom seen more beautiful objects than the indescribably delicate branching growths which such plumes display under strongly illuminated magnification. The basic structure of such plumes appears to consist of rather large needle-like to tabular crystals of some black mineral which shows strong metallic luster wherever it intersects the surface of a polished slab and is polished along with the agate. Some large "outcrops" were scratched with a needle and gave the following reactions: soft, almost graphitic in its yielding, leaving behind a bright slickensided surface; powder brown. From this data it is concluded that the mineral is not hematite but may be goethite or one of the manganese oxide minerals. The "stems" of the plumes consist of numerous crystals intertwined or branching from still larger individuals in the center. However, they form but a very small part of the plume as a whole since the very delicate plate-like growths which we recognize as the plumes themselves are in reality outward growths from the black crystal cores. In some examples, the exceedingly thin plumelets are brown in color as would be expected from color of the streak noted above.

As in the case of type (a) inclusions, plume-like inclusions are also surrounded by haloes of clear chalcedony and appear to form in essentially the same way. In support of the idea that the plumes grew in a solution rather than a gel, are the numerous specimens of plume agate which contain cavities in them lined with stalactitic growths of chalcedony. In every instance, the core of such stalactites is occupied by a plume, again indicating that chalcedony formed around the plumes rather than

the plumes having thrust their way into a cavity filling of gel on the verge of hardening.

Type (c), or dot-like inclusions are extremely common and account for the coloration of the famous Mexican agates, many of the Texas agates, and also the beautiful reddish agates of the region around Idar/Oberstein in Germany. Slightly different but nevertheless basically the same, are the spot inclusions found so abundantly and characteristically in Montana agates. All dot-type inclusions consist of very small opaque spots, largely of red or brown color, which form either individual dots or colonies of dots. Some larger dots when examined under magnification turn out to be small spheres, filled with clear chalcedony inside but delineated by numerous minute dots on the periphery. In Mexican agate, so far as I was able to observe, practically all of the bands consist of such dots in a variety of colors. In plumes, especially the type in which black fronds are capped with red, the red portions are not fronds or platelets at all but cloudy aggregates of thousands of exceedingly small dots. I have yet to see any sharply defined plume-like structures in red even in those plume specimens in which the red portions appear to be quite distinct with the naked eye.

#### *Montana agate*

The Montana agate "black" spots are worthy of special mention since they show some differences over other types. First of all, they are not black at all but deep rich brown which superficially looks black. Each dot apparently starts from a nucleus of some kind of mineral matter as yet unrecognized, and gradually becomes more indistinct in outline outward. Some dots look like jellyfish with rounded tops and many transparent brown filaments or tentacles hanging downward. Others are thin disks but still somewhat fuzzy in outline. All of them appear to be composed of mineral matter which is soluble in water because chalcedony areas can be seen where they gradually diffuse into the surroundings, staining them pale brown in the process.

All dot type inclusions appear to have the same history if we are to believe the evidence of microscopic examination: they appear to be partly dissolved or partly dispersed insoluble minerals which are concentrated along distinct band surfaces in chalcedony. Their arrangement strongly suggests that each emanates from a particle of mineral matter which was brought into the cavity and was drawn to the surface of already forming chalcedony bands and trapped by succeeding chalcedony growths. The Montana inclusions suggest that the narrow bands were partly gel and permitted some outward expansion of each original particle as well as some solution. In Mexican, Texas, and German agates, the spots are sharp and distinct, indicating lack of solution but



some dispersal nevertheless.

Type (d) or opaque curd-like or clotty inclusions are extremely common, especially in the partly translucent forms of chalcedony known as jaspers and cherts. The fine structure is very irregular and looks like nothing more than a suspension of solid particles which only partly dissolved in the cavity solutions. All gradations from highly translucent curdy material to actually earthy portions only slightly permeated by chalcedony are frequently observed in many jasper specimens. It is probable that such inclusions are various clay minerals, sometimes chlorites, or earthy mixtures of clays with metal oxides, etc. Where chalcedony thoroughly permeates porous rock or earthy mineral deposits, some very good polishing material results, however, much of it is too filled with soft spots of unconsolidated material to take good polishes.

#### Color In Chalcedony.

Ordinarily, in reflected light, pure chalcedony ranges in color from almost colorless to pale shades of gray, or blue-gray. In transmitted light, it often displays shades of very pale yellowish-brown. Examples showing strong blue color are probably pure chalcedony but with minute openings between fibers of just the right size to selectively scatter light and cause the development of blue light. This phenomenon in chalcedony is discussed by Pelto (1956) and White (1958). Other causes of colors in chalcedony are due to discrete inclusions as mentioned above, and also to the deposit of coloring matter within the exceedingly small pores between chalcedony fiber crystals.

Introduction of coloring matter in chalcedony pore spaces calls for mineral matter to be in solution since larger particles will not fit between fibers. The uniform reddish to reddish-brown tones of carnelian and sard are believed to result from soluble iron compounds trapped in chalcedony during growth but remaining transparent until decomposed into soluble iron oxides which then impart coloration. Similar changes are noted in development of iron compounds in swamps and bogs where invisible iron compounds dissolved in water are removed by plant life and precipitated as insoluble compounds which are visible when sufficiently accumulated. Some Uruguayan and Brazilian agates contain enough dissolved iron compounds to change to carnelian type colors when strongly heated. The effect of the heating is to break down the compounds into the visible iron oxides mentioned before. This principle is utilized today for dyeing agates whereby a number of metallic compounds or organic dyes, which can go into solution and can be gradually soaked up by the porous chalcedony raw material, are converted into colored compounds. Some changes are effected by heating the pieces and others by soaking in chemical agents which then cause desired reac-

tions within pore spaces. The latter process is widely used to impact very dark brown color using a sugar solution followed by immersion in concentrated sulfuric acid. The acid creeps into the pores, destroys the sugar, and leaves behind minute carbon particles. *Iris Agate.*

In closing this brief article on theories of chalcedony formation, the excellent work of F. T. Jones (1952) on the formation and properties of iris agate should be mentioned. The most important conclusions which Jones reached are as follows:

- Iris agate owes its lovely spectral colors to the presence of a diffraction grating structure.
- The lines of the grating are the edges of bands with alternately higher and lower refractive indexes along the boundaries.
- Banding lines have been measured at from 400 to 15,000 lines per inch.
- Any chalcedony deposit can provide iris agate.
- The likelihood of iris structure seems greatest in those translucent specimens showing "turtleback."
- Best effects are obtained when slices are cut at right angles to the banding and made very thin.

The diffraction structure mentioned above is the same which is now believed to cause the splendid colors of precious opal. Stated simply, all diffraction gratings are merely surfaces or transparencies where numerous parallel grooves or lines, or, in the case of iris agate, lines along which the velocity of light is changed slightly, causing light rays to interfere. This in turn causes some portions of the ordinary "white" light to be destroyed, leaving only colored portions to pass through, hence the "color."

This effect may be seen even upon long-play phonograph records where the many minute circular grooves cause interference of light. Records held in a certain way will show some iridescence, as if coated with a film of iridescent oil.

Iris agate is found in quite a few places in North America, the most important being Montana and Oregon. Excellent iris also occurs in some Mexican nodules, particularly those which are mostly clear and colorless inside and thus reckoned as "duds" by most persons. However, such nodules may or may not be duds, but only slicing thin and dipping of the slices in oil and holding up to a light will tell. I have found slices about one sixteenth inch thick can be cut by slow feeding in a true-running diamond saw. Thin slices are much more spectacular when polished. Observation of the iris effect is of course only possible when the slice is held at about arm's length toward a pinpoint light; the latter must also be about an arm's length away from the slice.

#### Conclusion.

The problems of explaining the formation of chalcedony, its inclusions, and

its colors, need far more study before thoroughly convincing explanations can be advanced. It is regrettable that more qualified mineralogists have not taken up the challenges offered, and made attempts to study this fascinating substance more closely than has been done. With the success of recent reconstruction of pegmatites in miniature, using sealed pressure vessels, it should not be out of the question to duplicate some of nature's chalcedony handiwork in the laboratory. There is plenty of raw material available and it should be possible to take blocks of basalt, rhyolite, or other rocks in which chalcedony frequently occurs, make artificial openings in them, supply the necessary solutions to them, and see what happens. Will the cavities fill up with chalcedony? Will bandings form, and if so, will they be precisely the same as noted in natural examples? If the most recent findings are true, then the pressures and temperatures required are relatively modest and should make it easier to design and operate suitable laboratory equipment. In any case, and even before laboratory work takes place, there is still much field work to be done, by this I mean the obtaining of as many examples of chalcedony varieties as possible—from *field sources*—and then examining them in the light of field information. It can do little good to examine fragments of the geological picture, namely, the chalcedony nodules, thundereggs, seam fillings, etc., without examining the environment from which they came.

#### REFERENCES

- ALEXANDER, G. B., HESTON, W. M. & ILLER, H. K. (1954), The Solubility of Amorphous Silica in Water: *Journal of Physical Chemistry*, v. 58, p. 453-455
- BROWN, Roland W. (1957), Plantlike Features in Thundereggs and Geodes: *Smithsonian Report for 1956*, p. 329-339
- CARR, R. M. & W. S. FYFE (1958), Some Observations on the Crystallization of Amorphous Silica: *American Mineralogist*, v. 43, p. 908-916
- FISCHER, Walther (1954), Zum Problem der Achatgenese: *Neues Jahrbuch f. Min., Abh.*, 86, 3, p. 367-392
- FOLK, Robert K. & WEAVER, C. E. (1952), A Study of the Texture and Composition of Chert: *American Journal of Science*, v. 250, p. 489-510
- v. FREYBERG, B. (1927), Observaciones geológicas en la region de las agatas de la Serra Geral (Rio Grande do Sul, Brasil): *Boletim Academia Nacional de ciencias*, Cordoba, v. 30, p. 129-170
- KRAUSKOPF, Konrad B. (1956), Dissolution and precipitation of silica at low temperatures: *Geochimica et Cosmochimica Acta*, v. 10, p. 1-26
- LIESEGANG, Raphael E. (1915), *Die Achate*, Dresden and Leipzig.
- LINCK, G. & H. HEINZ (1930), Ergebnisse der Arbeit des Herrn H. Heinz über die Achate: *Chemie die Erde*, v. 4, p. 526-528
- LUND, E. H. (1960), Chalcedony and Quartz Crystals in Silicified Coral: *American Mineralogist*, v. 45, p. 1304-1307
- NACKEN, R. (1948), Über die Nachbildung von Chalcedon-Mandeln: *Natur und Volk*, v. 78, p. 2-8
- PELTO, C. R. (1956), A Study of Chalcedony: *American Journal of Science*, v. 254, p. 32-50
- REIS, O. M. (1916-1920), Einzelheiten über Bau und Entstehung von Enhydros, Kalzitachat und Achat: *Geognost Jahreshäfte*, 23/30 p. 81-298, 31, p. 1-92
- SCHALLER, W. T. (1932), The Crystal Cavities of the New Jersey Zeolite Region: *Bulletin 832*, U.S. Geological Survey
- SCHLOSSMACHER, K. (1950), Die Entstehung der Achate: *Schmuck und edles Gerat*, p. 23-26, 55-57
- WHITE, J. F. & J. F. CORWIN (1961), Synthesis and Origin of Chalcedony: *American Mineralogist*, v. 46, p. 112-119



# HOW TO HAVE SUCCESSFUL FIELD TRIPS

*By June Culp Zeitner*

How many times have you gone on a much anticipated field trip only to have it fall flat — a complete dud? We have blamed the following for our failures; the weather, our source of information, our car, the highway department, and the rockhounds who were there before us. But this past year we have called almost every trip an outstanding success, for we found out that the real source of failures was poor or inadequate preparation.

With the simple procedure which follows we hope to enjoy more trips than ever. Perhaps a few of these ideas gleaned from many years of trial and error will help you too.

## *Where To Go*

It is surprising the number of rockhounds who start on a trip with no special destination in mind. After wasting gallons of gas we found that the best preparation for any trip is to study every magazine article, book, and map, available on the area we are in. The sources of such help are many.

1. Most mineral publications have a book department stocked with materials covering all parts of the country. Magazines in our field regularly feature articles about productive areas for "find-it-yourself" rockhounds.

2. Rock shops not only carry books, magazines, and maps, but are often staffed by friendly rockhounds who are glad to give directions and advice about their area. The *Lapidary Journal* Book Department carries all the field-trip books.

3. The National Geological Survey, Dept. of Interior, Washington, 25, D. C. has available for a small fee, material and maps on the geology of all states.

4. Your State Dept. of Mines or College of Mines will have books or maps as well as displays of local minerals.

5. Your county seat will have topographic maps showing details of the county road system.

6. The highway boards usually have lists of sand and gravel pits and rock quarries.

7. Many Chambers of Commerce in minerally blessed areas will put you in touch with local rockhounds.

8. The rock clubs listed in the *Rockhound Buyers Guide* welcome visitors. Many clubs also sponsor field trips which guests may attend. Some clubs even have leases on good hunting grounds.

## *How To Get Ready YOURSELF*

First you need to be ready mentally for the trip you are about to make. If you go, for example, with the idea that you will be satisfied with nothing less than a prize piece of fire agate, you are beat before you start.

The early prospectors of gold rush fame, passed up fortunes in silver and gemstones because all they were seeking was gold. Many died poor because all they knew was gold — they were not prepared for their trips. In this day of books, magazines, clubs, rock shops, shows, and conventions we have little excuse to go into the field poorly prepared. If we are going to look for fire agate, as in the example above, we should know not only the type of formation in which it occurs but also other gems and minerals which may be found in the same locality.

We went on a field trip to a copper mine in Arizona with 200 people. Most fairly fell out of their cars to run and start pounding the first rock they saw. All over you could hear people ask, "What are we looking for?"

A very few found some rare crystals and native copper. It was not the fault of the field trip chairman that everyone didn't go home "loaded," for there was plenty of excellent material there.

We think it adds immeasurably to our trips to become familiar with not only the rocks of the area but also the birds, the vegetation, the landmarks, and the early history. The sight of the shy phainopepla sitting on a saguaro in bloom can make a mediocre field trip memorable.

Now say that we are mentally ready for a successful trip. What physical comforts must we provide for? We have had trips ruined by exposing ourselves to sunburn, frostbite, sand-blasting and rain-drenching. So now we wear comfortable light weight washable clothing — long sleeved shirts, and rough soled shoes. But we also have packed permanently in the trunk of the car the following: Warm light-weight sweaters and crushable sun hats; extra shoes; plastic roll up rain capes and hoods; an old blanket; a first aid kit; emergency food rations; canned liquids such as fruit juices, tomato juice, etc.

## *THE CAR*

On one field trip vacation our neighbors on one side had a truck, on the other side, a jeep. We had a heavy passenger car. At the end of the collecting

period we had the most rocks, the greatest variety, and had been to more places. I am not saying we can go everywhere a jeep can, but a good driver with a well equipped car can get to some very out-of-the-way spots.

We have overload springs on the car which is both a help for clearance and carrying heavy loads. We always have tires with good treads and carry slightly more air in them than for city driving. Also, we find that in most good rock areas frost is not uncommon, so the radiator always has antifreeze.

For emergency equipment we have a shovel, chains, and flares, and a roll of two lengths of chickenwire is invaluable in getting out of sand. Although you can get out of sand by deflating your tires, a tire spark plug pump beats a hand pump for reinflating them.

Many rockhounds carry extra gas and a few cans of oil, and on some trips this is advisable. A flashlight in the car is a must. An emergency lamp with cord that plugs into the cigarette lighter saves flashlight batteries, for work around the car itself.

## *FOR YOUR ROCKS*

We have found that a newspaper boys' bag makes a good rock sack. Prospectors canvas assay bags are also good "pokes." A pocket sewed to the side of your bag will come in handy for such things as notebook and pencil for field notes, facial tissues to wrap any delicate or tiny specimens, and even food refreshments such as apples or chocolate.

Under the front seat of the car I always have a shallow sturdy box in which I can safely lay crystals, thumbnails, fossils or anything requiring special care. This holds a thick layer of quartered newspaper sheets.

Our rough rock boxes are always ready in the back of the car. Our favorites are four-gallon paint boxes. These are well made heavy boxes, uniform in size so they stack well, and can be folded flat when not in use. They are also just about as large as one person can manage alone. Each holds from 40 to 70 pounds of rock. Your paint or hardware dealer will probably be glad to save such boxes for you. Another good kind of box is the type car seat covers come packed in. They are sturdy well proportioned and shallow enough that when full you can see what you have, and the top specimen will not be heavy enough to crush the lower ones. Empty canned beer cartons are



also an ideal size for this use.

We always carry mineral glasses on shoestrings around our necks; on the same strings we have whistles which we use to communicate in the field. We have our own code for these whistles and anyone can invent one which suits them.

1. A single blast of the whistle is merely an inquiry. If you can't see some member of your party and wonder which direction he went, a single shrill blast should bring an answering blast, helping you to locate him.

2. Two puffs of a whistle indicates that an interesting area has been discovered, and it might pay the others to join you.

3. Three sharp notes, repeated after a pause, until you get an answer means "Emergency, come at once!"

Our equipment includes the standard pick, a maul, a pry bar, and a chisel. A pocket knife and pliers are often handy. We wrap heavy equipment in a canvas tarp which more than once has been used to drag or carry heavy specimen in safety.

#### *Special Help for Better Results*

If possible find out ahead the name of the property owner you will have to confront. If you know far enough ahead to write for permission you will be expected and welcomed.

Always take a small box of trading and gift material. We keep ours packed in a plastic car sized waste basket. There are slabs of several unusual materials, a few crystal specimen, and several nice sets of gem jewelry for both men and women. It works wonders!

Unfortunately the word *rockhound* has become almost a cuss word to ranchers in some areas. We find it is a help to keep the car clean, to dress neatly ourselves, and not to stress "rocks" when seeking to enter or pass through private property. We have cameras and mention that we would like to take some pictures, (one of the ranchers' cute child might not hurt) that we also like to look for birds, have a picnic, and perhaps pick up a few rocks. Now this sounds evasive, but it is now absolutely necessary in too many areas that you assure the rancher you are non-commercial and non-destructive. If you mention the word "rock" in your first breath your answer is often a firm and quick "no" before you can even finish your sentence.

If this is an area you especially wish to get in, take along a big picnic lunch and invite the owners to join you. Make your first trip a "get acquainted" trip. Chances are you will be invited back to look for rocks as often as you wish.

Last, don't abuse any privileges. This will not only make it easier for you next time but will help the reputation of the whole hobby.

# Why Not Use An AGATE LOCATOR?

*By Ken Kyte*

Two years ago, while conversing with a rockhound acquaintance at the Texas Federation Show in McAllen, the question was asked: "How do you manage to find such quantities of Agates in the 'swamps' of Louisiana?" Agates are not found in swamps, per se, but this appeared to be a query that was just begging for a tart reply. "My friend, the best way to find agates in Louisiana, or anywhere else, is to use an Agate Locator!" You can well imagine the snort of disbelief and derision that greeted this remark. After a short interval of silence and with raised eye-brows, the question was posed: "If there is such a thing, then how would it work and why isn't the device better known?"

"The gem hunting fraternity has been used to searching for agates using the well-known methods of looking, licking and chipping. For a fact, Agate hunters, like fishermen arise in the wee hours of the morning to make a hunt for agates and perhaps both groups feel results are more assured when a real early start is made.

My good friend, Jud Locke of Gulfport, Miss., and widely known as former President of The Rollin' Rock Club—Of Texas And Any Other State Or

Country Of The World (O.T.A.A.O.S. O.C.O.T.W.), who is especially wise in the ways of the wiley agate claims that the reason to get an early start is because the big and fine agates crawl away and hide during the heat of the day; only coming out into the open when it is cool and damp. Of course, where there is water handy, a stream, lake, pond or ocean, big agates crawl in the water to avoid the direct, strong sunlight of midday. He says this is the reason why only little, puny and sorry agates are found when it is really hot, or in the afternoon when everything looks dusty and dried out.

You will have to admit these things seem to add up . . . they are at least in line with the experiences of those who hunt agates. Why not, then, take advantage of these supposed proclivities of the elusive agate and take a device with you, when you search the gravel pits, river beaches and rock strewn hill-sides that will fool the big and pretty agates into crawling out into the bright sunshine where you can see them and pick them up?"

At this point in the conversation my acquaintance had a certain look about his face which would indicate a type of



Fig. 2. There are eleven agates visible in this picture, taken after working over area thoroughly with Agate Locator. Can you find them?



resigned patience being held by a thin thread; that he momentarily expected the arrival of the boys in white to come and escort me to the lony-bin. Not being able to escape graciously, my victim had little choice but to continue to listen and hope for a break to get away from me. Pushing my advantage and bending his ear for all it was worth, and because he had brought this on himself, I continued with the explanation.

"Yes sirree, that Agate Locator is really the stuff. Just carry it to a spot where there is plenty of rock, squat down and turn it on. Work it over an area of two or three square feet. Look this spot over carefully. If there is a good agate there it will crawl right out where you can see it and pick it up! Sure it is amazing! Really uncanny how well it works . . . even on a picked-over spot, too! Why just the other day my wife and I were working over a gravel pile. I'll give her credit, she's really got an eagle-eye for agates, yes, it was a warm sunny afternoon, sort of on the perspirey side, too.

Well, I followed right behind where she had been looking, with my Agate Locator, working slowly and carefully, it takes a bit of time for those big babies to crawl out where you can spot 'em. Anyway, after about an hour we compared results. My wife had a nice sack of agates, alright, really fine, too. But when I dumped mine out for inspection, there was almost twice the quantity, bigger ones, prettier ones and more solid ones! She nearly flipped, 'cause they had come from territory she had just picked over! That Agate Locator sure was the difference between just fair luck and my outstanding success.

Another time, we were hunting on a fine gravel bar in Pearl River and I had that Locator. Those fine big agates were popping up right and left wherever the

Locator was played over the rocks. . . . Boy! Was I ever having a ball! You know. . . ."

At this point my acquaintance turned

up missing . . . long gone, just as I was about to make him a bet that if he would take me to a picked over gravel pile, I would prove my point. I would



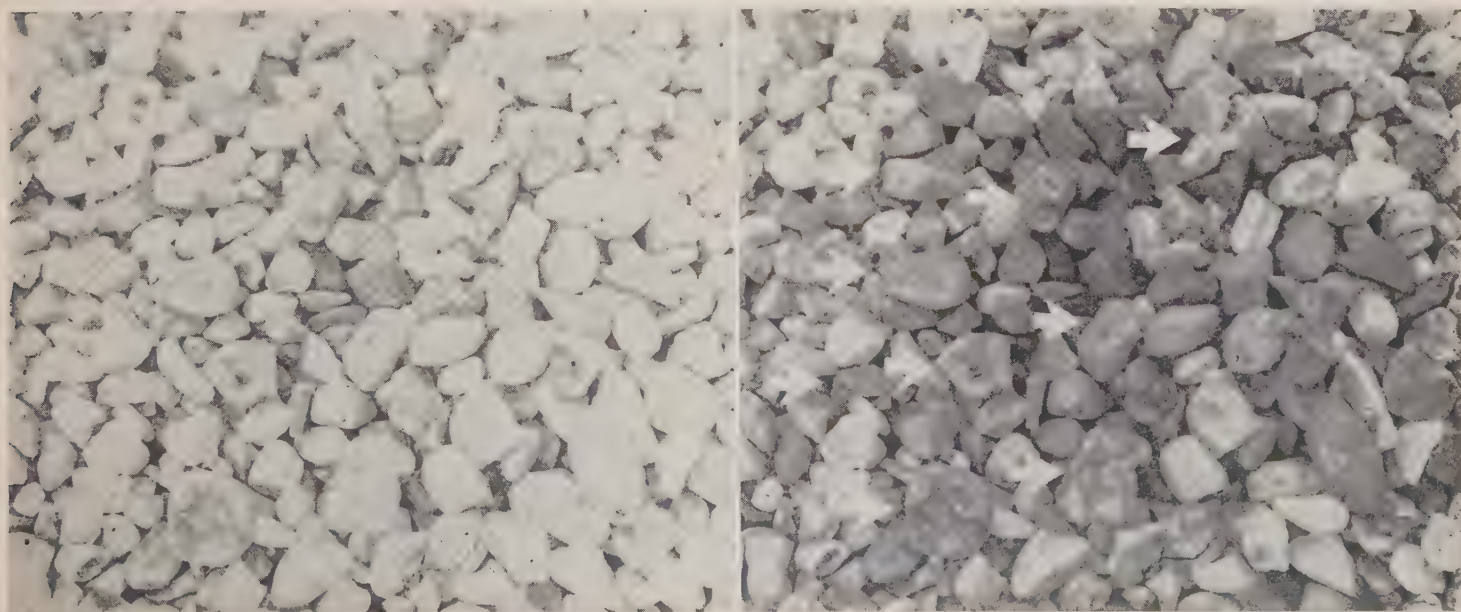
### *Yes There Is Such a Thing!*

*Fig. 3. This is where the agate locator makes those pretty agates crawl out where you can see them! (This was taken at the end of a hot afternoon rockhunt and I did the best I could but there was no overcoming that "pooped-out" appearance!)*

## BEFORE

*Fig. 1. These two pictures are identical spots, "before & after" using the Agate Locator. There are nine agates visible in the "after" version.*

## AFTER





bring the Agate Locator and show him how well it worked—right in his own bailiwick, too. Guess I was too carried away with bragging on the Locator to tell him I had it with me and would be glad to demonstrate just how it operated.

That afternoon the lure of the nearby agate-covered hills proved stronger than the urge to see the remainder of the show and there was another day for that, so we took out for a hunt, heading up a small road leading into the hills. The first cut that showed a good amount of exposed gravel was where we stopped to hunt, right on the shoulder of the road. The sun was high overhead, beating down quite unmercifully, which is normal in those South Texas hills. The Agate Locator was taken from the car, set on the ground and put to work.

In a matter of seconds a nice big red “seaweed” moss agate appeared. Just beyond, a fine banded agate peeked out from between two sorry-looking jaspers. Soon a fine “Montana type” agate with good black inclusions put in its appearance. With this sort of hunting, the collecting sack soon took on a satisfying heft. Really, the picture was rosy. Right after retrieving a glassy clear specimen with green moss, the spell was broken.

Suddenly, accompanied by screeching tires and brakes, gravel flying every which way, a car came to an unceremonious and abrupt halt perilously close

to the barbed wire fence alongside the road! It was my acquaintance from the show who had disappeared so quietly and had given the impression that my cogs had slipped. He quickly got out of his car, ran to where I was working with my Agate Locator. Maybe he thought he had caught me engaged in using a machine I didn't want him to see! As a matter of fact he had the eager air of a cat pouncing on a small bird.

At this moment it dawned on him exactly what an Agate Locator was. After emitting a few explicit and appropriate epithets, mostly in self-condemnation for not having thought of the gadget himself and for the utterly simple explanation of the contrivance, he shook my hand, apologized for having thought me balmy, thanked me for having shown him such a wonderful idea, quickly got in his car, turned around and headed for the little town over the hill to go to a hardware store and buy himself an Agate Locator!

In case you haven't figured out what an “AGATE LOCATOR” is by now, from the picture, it is nothing more nor less than a garden bug sprayer! To make its magic work for you, add about six feet of hose, adjust the nozzle to the finest spray and fill it with water, pump it up and go to work. In the years since I bought mine, enterprising

manufacturers have thought of a gimmick for the rockhound who is inclined to do things the easy way. These sprayers are available with wheels. If you are the ingenious type, it may occur to you that a rack may be added to tote your sack of rocks . . . how lucky can we get!

In spite of the humorous expose in connection with it, this gadget really works and is a very useful tool for the rockhound, whether it is for finding agates, petrified wood, or fossils in gravelly locations. I got the original idea from Wilford A. Beveridge, 206 North Broad St., Nazareth, Pennsylvania, who uses it to expose gem Williamsite in the dumps of the Line Pits on the Maryland, Pennsylvania line . . . a chrome mine. My contributions were merely to use it on agates and to put the long hose on to avoid moving the tank at too frequent intervals.

Editors Note: As long ago as 1950, Ken Snyder and wife of Donna, Texas showed the Editor how they used a Flit-gun with a quart can of water on it for the same purpose. Those Rio Grande Valley agates really “sizzle” when you spray them—you have to be fast on the pick-up! Otherwise they'll disappear right in front of your eyes.

## PICTURES IN STONES



When H. B. Heiser and his wife, of Norwalk, Ohio, made a trip in September, 1960, to Oregon, they had the time of their lives . . . but let him tell it:

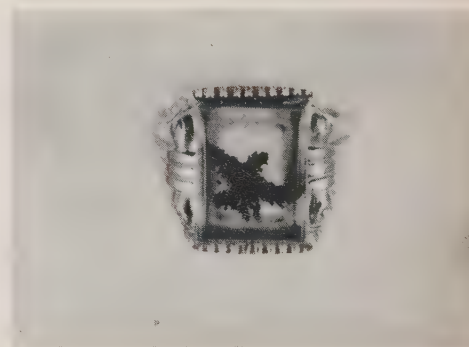
“Last September my wife and I made a trip to Oregon and attended the Convention of the Northwest Federation in Eugene. While there we went on a few field trips by ourselves, and many with the members of the Eugene society. We did not know that there were so many cutting rocks available just for the hunting and bringing home. We have never had a better time, on any trip, anywhere,

in spite of the fact that our car and trailer were wrecked on the way home and we spent a week in the hospital.

“One of the rocks we thought might be especially interesting is a ‘Montana’ type agate we found near Brownsville, Oregon (if our records are straight) and which I have since cut and polished and have made into a pendant. As I am new at silver work I am not so sure as to the quality of the workmanship or design, but the stone has me entranced. The scene it depicts reminds me very much of the vulcanism and mists enveloping the earth in its formative stages, as were shown to us recently by geologists who had sketches of different ideas as to what the earth looked like in those formative millions of years, before there was any life possible. I would not be able to paint a picture that more nearly showed the fiery eruptions, mountain tops sticking through the low hanging vapors, a fiery glow over everything, and some low hanging stringy clouds of vapor reflecting the eruptions, with a bleakness and loneliness over the whole picture, and no signs of vegetation, for that was yet to be—in how many millions of years, no one knows.

“This volcano is not at the back of the cab, and not on the surface, but sandwiched in between the two surfaces. If the stone had been sliced at any other angle this picture would have been lost. How lucky can a person be? Even having cut the slice just a little thinner

might have been disastrous. I guess, though, that is the way of all pictures in rock, and one continually wonders what it might have looked like if it had been cut another way. That is the fascination of slabbing—each slice is another arrangement of the colors and lines, and that is why I frequently cut a rock on five or six sides, not only to square it up, but to find the best side for design and color for making cabs or just as a specimen. There is usually one side that is better than all of the others.”



## “AMERICAN EAGLE” AGATE MAKES RING

*This beautiful Montana agate is the prized possession of E. E. Smith of Geode Industries, 106 W. Main St., New London, Iowa. The dendrite shows a perfect image of an eagle in flight.*



# AGATE VARIETIES OF THE PACIFIC NORTHWEST

*By Clyde L. Browning*

Agate materials of the Pacific Northwest occur for the most part in four great areas. Each one is associated, more or less, with one of more geological periods. For instance, the beach materials are in close association with the igneous intrusions of the relatively young coast range of mountains, formed by a comparatively recent uplift as geological time is reckoned. This range of mountains extending north to the Olympic peninsula and south toward southern California is made up mostly of sedimentary rocks, but contains many igneous intrusions of basalt, and rhyolite rocks which seem to foster the formation of agate materials.

The Cascade range of mountains is about one hundred and fifty miles inland from the west coast and parallel to it, mostly of volcanic origin with extinct volcanoes like Crater Lake, Mount Hood near Portland, Mount Rainier in Washington and a dozen others along the range. An inland sea once filled the Willamette valley and Puget Sound of Oregon and Washington between these two ranges of mountains. Erosion of the western slopes of the Cascades and the waves on the ancient beaches left quantities of smooth agates along the foothills and stream gravels after the sea receded from western Oregon and Western Washington. Agates as float and agate materials in place are found in this general area.

East of the Cascade mountains another story was written in the surface of the earth. Here the mountain building forces of the Cascades caused an uplift across the Columbia River canyon which was the principal drainage of eastern Washington, eastern Oregon, southern Idaho, and part of Utah. This uplift or anticline stopped this drainage and formed a great inland lake known to geologists as Lake Condon. This lake submerged most of eastern Washington and eastern Oregon and laid down extensive sediments in the area. It is within the shore line of this ancient lake that we find the marvelous agate materials of eastern Oregon and the outstanding opalized woods of eastern Washington.

The sedimentaries of old Lake Condon are now buried under a hundred feet or more of basalt, rhyolite, igneous rocks which flowed out over the land or was extruded from the vents, fissures or buttes which can be seen throughout the area. Subsequent erosion and some faulting has exposed the strata which contains the beautiful materials. Some of the beautiful plume agates found here are almost precious gems.

The fourth major area is that of southwestern Idaho where a geological history similar to that of eastern Oregon is associated with the uplift of the Columbia plateau, ancient lake formation on the Snake river and the vulcanism of the area in general. This area has in years past been worked very little for cutting materials, yet some beautiful gems have come from there. The Steens and Pueblo mountains will no doubt be good producers in the future as more prospecting is done in this part of the country.

## *Agate only*

Since we are devoting this space to a consideration of agate only, we will only mention that all four of these major areas produce a great variety of other stones of interest to the lapidary. There are opalized and agatized woods, bogs, flora and fauna specimens of hundreds of kinds.

These are specimens such as pine cones, seeds, nuts, fish, clams, bones, teeth, leaves, twigs and trees; things of organic origin wherein the carbon has been replaced atom for atom with silica have become compact solid agate. As erosion carries away the softer country rock or disintegrates the opalized materials the agate specimen remains almost indestructible.

## *Collecting areas*

Now to consider some of the specific collecting areas and see some of the typical materials your author has photographed of the more popular types and kinds of agate from the northwest. We are indebted to many friends who are members of The Southern Siskiyou Gem and Mineral Society who loaned their beautiful handiwork for these photos. To mention a few and express a thank you to Hi Wellman, Allen Carter, Primo Martini, Duke Duramus, Tony Correa and others for the use of part of their collections.

## *Fortification Agate*

The Willamette river and western Washington were no doubt the first to supply agate for the lapidary. These are mostly the fortification type of agate with many concentric bands of varying color or other characteristics so that a sliced section of the agate reminds one of the concentric walls of old military fortifications.

This is by far the most common type of agate and nearly all collecting areas produce some of it but the color varies with the origin. For instance the agate found in place near Sweet Home, Oregon

on the Calapooya river is a lavender color, called amethystine. A similar or perhaps the same agate occurs on the other side of the Cascade Mountains in a small range called the Mutton Mountains. The beautiful blue agate is found farther north near Cle Elum and Liberty, Washington, not far from Ellensburg, from which it takes its name. The red carnelian type is found a few miles east of Klickitat, Washington and also in streams of Louis county, near Chehalis. There is solid black agate up the Deschutes river a few miles above Maupin, Oregon. This occurs as a lining and filling of thunder eggs and is uranium-bearing, highly fluorescent material. White, amber and tan agates are common in the beach gravels as well as in the inland beds.

## *Sagenite Agate*

More rare but widely scattered is the sagenite agate with its clusters of needle-like inclusions. Very fine hair like inclusions give rise to the name of maiden hair agate. Some sagenites appear to be small tubes in the clear agate radiating from a point, like a pin cushion. These stones are often found in the beach gravels and at Agate Flat and Agate Desert in southern Oregon. Like each of the other types of agate it is not possible to list here all the locations where these stones are found in the Northwest, space will only permit a general survey of the subject. There are details available to the collector interested in any particular known deposit, in the articles which have previously appeared in *The Lapidary Journal* and in various "Gem Trail" guide books.

## *Moss Agate*

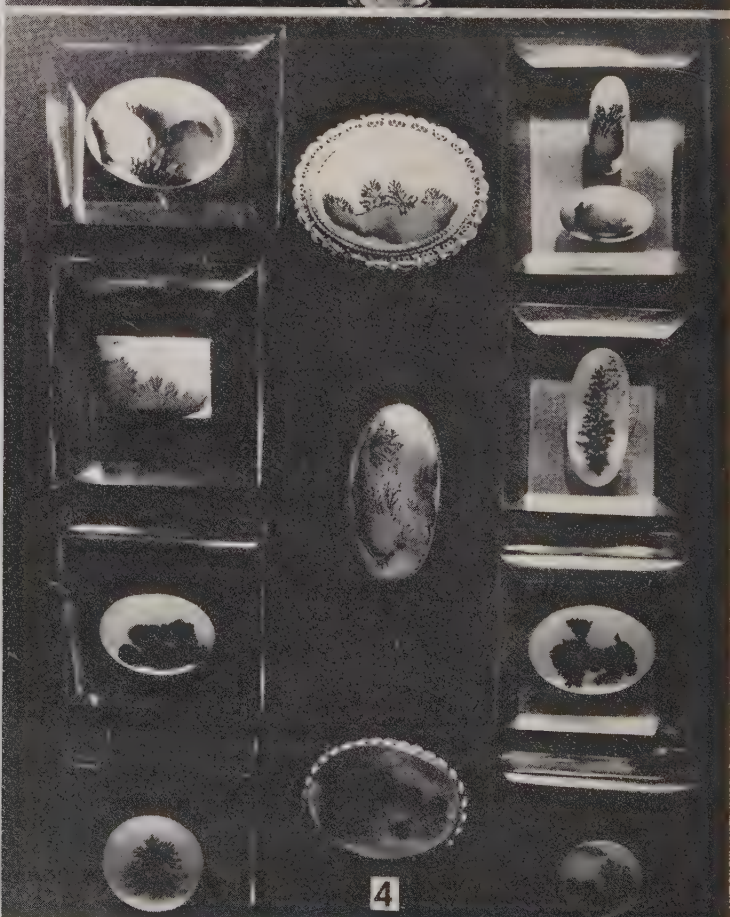
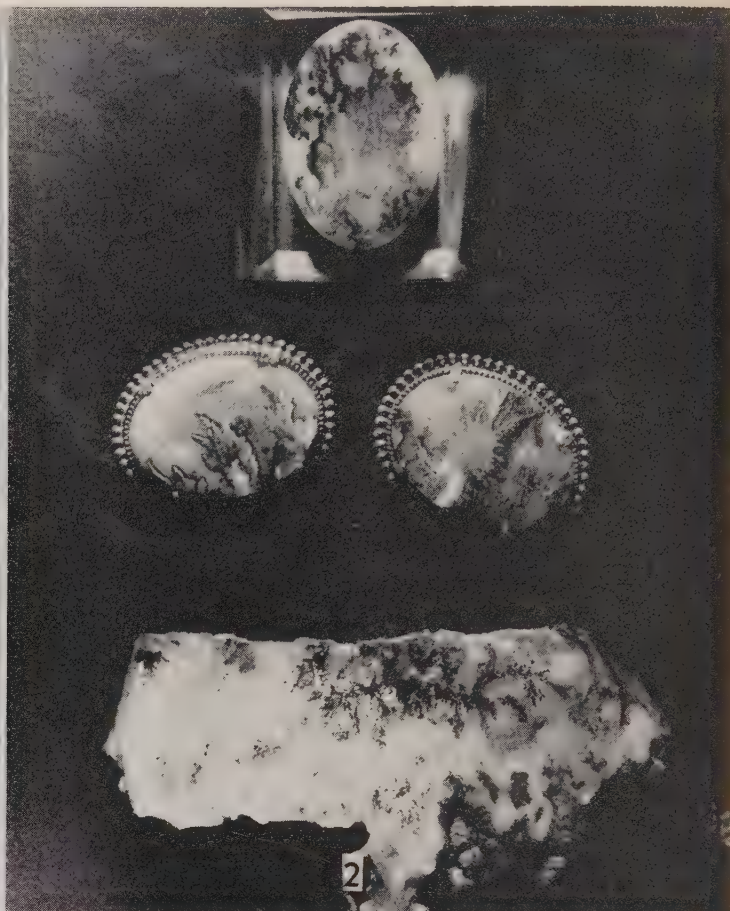
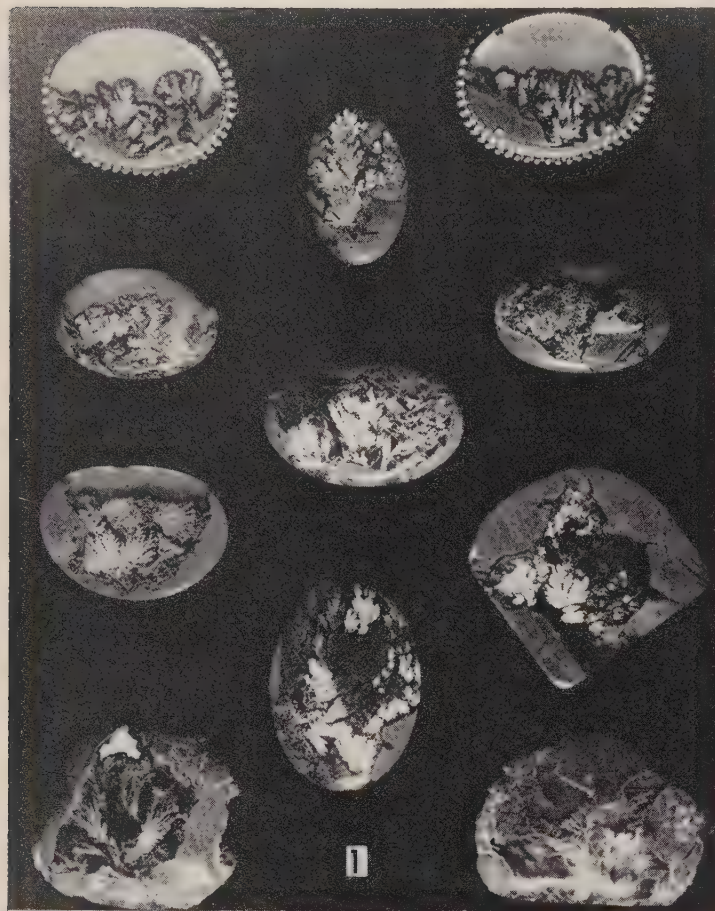
This type agate is not so widely scattered as some. As moss agate I think of the fine tangled threadlike inclusions of varying color, shape and density resembling the stringy green and brown moss often found in swamp water. There are several places around Prineville, Oregon, where this moss is found in bright green, bright yellow, cream, tan, pink and brown, sometimes several colors in the same stone.

## *Dendritic black and white agate*

These are highly desirable and look like the well-known Montana agate with its scenics, trees, shrubs and myriad designs of black in the clear or milk white agate. There is a considerable quantity of truly fine black and white dendritic agate in the northwest. To name a few spots, such as Sucker Creek, Idaho,



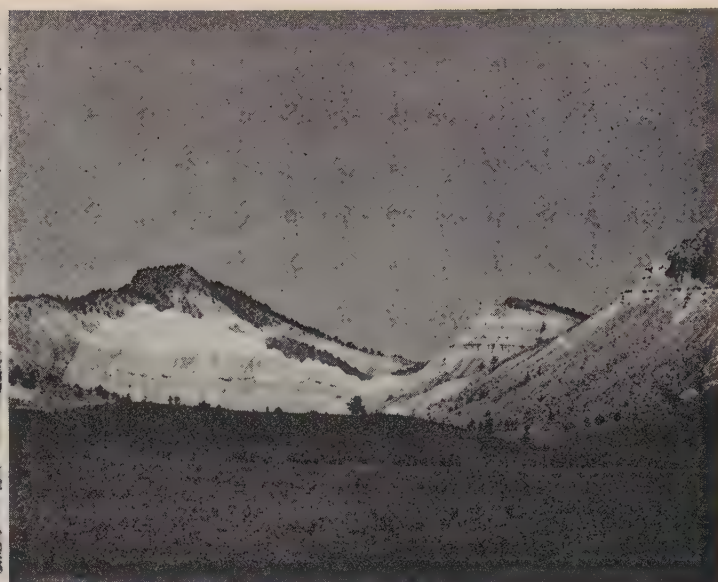
# The Beautiful Agate Varieties of the Northwestern States







A view of the geology in an agate rich country, the canyon walls of Crooked River below Prineville, Oregon. Clearly visible are the sedimentary rocks which contain the agate materials. These sedimentaries of ancient Lake Condon were overlain with basalt, rhyolite, igneous



rocks upwards of a hundred feet in thickness. A fault scarp in the upper Crooked River country where the agate bearing sedimentaries of both the Condon and the John Day formations are exposed to erosion.

1. These are the multi-colored plume agates found on the famous Friday Ranch (Fulton Ranch) beds. Some of these are partly shaped from the rough condition, some are finished ready to be mounted. The two at the top are mounted gems. The colors are bright reds, greens, yellows, tans, pinks and black, all in the same stone.
2. Idaho plume agate from the Sucker Creek area west of Homedale, Idaho. Note the rough material, the cabochon mounted on lucite and the mounted broaches. Colors are white, cream through tan to yellow.

3. Dendritic agate from Agate Flat in various stages. The rough stones at the bottom; the center bottom is sagenite agate. Sliced and partially shaped stones. Others finished ready for mounting. Note the beaver upper center, also the fan dancer; the atom bomb cloud, the trees on an island, etc. Colors are black and white.
4. Beautiful black dendrites in clear and white agate mounted on lucite blocks. These agates come from Agate Flat located on the California-Oregon state line a few miles east of Hornbrook, Calif. Colors are black and white and a little tan. "Quartz minerals" cutting material (agate) as it appears in a large retail rock shop in Oregon.



Carey plume agate from the Carey Ranch a few miles south of Prineville, Oregon. The colors are white to clear agate with bright fire red dendrites. Slices of plume agate—The center piece is agate with patterns of real-



gar and orpiment, yellow through lavender in color. The four others are clear to white agate dendrites mostly fire red to a little tan and a little black. The center stone comes from Goshen, Oregon, the others from the Eagle Rock area near Prineville, Oregon.





# OREGON'S AGATE BEACHES

*By Clyde L. Browning*

## AGATE VARIETIES OF THE PACIFIC NORTHWEST (Cont'd)

Owyhee river country and a deposit east of Burns, Oregon, where more prospecting should be done. There is Eagle Rock, and Crooked River, near Prineville, Oregon. The Agate Desert and Rogue river beds near Medford, Oregon have produced heavily for years.

There is a bed of black and white dendritic agate located astride the California-Oregon state line and about fifteen miles east of Hornbrook, Calif., known as Agate Flat or Jenny Creek, sometimes referred to as Copco. Access to this area is difficult but like the Agate Desert it has yielded tremendous quantities of superfine dendritic material. Local people tell of the four horse teams and wagons who carried away the surface material to San Francisco in early days when the old stage route crossed the agate flat.

Also near Hornbrook, about four miles east, is a quantity of fair blood-stone, a green plasma with red spots and streaks. This is a near relative to agate as is the plentiful supply of red, tan and brown jaspers found almost anywhere that agate is found.

### *Rogueite*

Named after the Rogue river valley where it occurs is a milk white agate with bright green markings, patterns and designs and is still in good supply.

### *Plume Agate*

Probably the most desirable of all agate gems in the northwest is the amazingly colorful plume agate of Central Oregon. The color and multicolor patterns vary from one deposit to another. Plume agate is found in a number of places roughly in the triangle formed from Bend to John Day, to Maupin, to Bend, Oregon. Yet there are several de-

posits outside of this triangle.

In most cases the plume agate is found to be the core or filling of a thunder egg and only a very small percentage of thunder eggs are so favored, some are empty; some have small crystals like a geode. The plume found at Carey Ranch is a fiery red pattern of delicate design, while Ochoco plume is a little heavier pattern in pea green to olive-green, like pine trees. The Eagle Rock plume shows a darker red to brown, and traces of black, like long sprays of fire weed. White plume from Bear Creek and Shasta Valley is pure milk white to cream sprays in clear agate.

The Pony Butte on Friday Ranch (now Fulton Beds) with a vein of Polka Dot agate in place and blue agate-filled thunder eggs has supplied the lapidary a veritable treasure in gems. The stones that were collected free of charge were undoubtedly worth much more than the value of the thousands and thousands of acres of land which comprises the huge ranch. Almost unbelievable to one who has not seen the rare beauty of a multi-colored plume agate taken from the interior of a worthless looking brownish rock, the Friday Plume is almost a precious gem, a single cabochon containing a tree, or shrub, a scene or a blooming flower, may have a brown base like earth at the foot of the shrub. The shrub may be sprays of pea or olive-green with branches of cream or tan amid the green, bright flowers in red, yellow or pink at the tops of the sprays, or a mixture of these colors. That's a Friday Plume agate!

A bluish sky or water background to such an array of colored dendrites in the stone is also not uncommon. So there you have a short word picture of agate in the Northwest as we know it.

Best beach agate picking of the year is Now. The Oregon beaches nearly always yield their best cutting material in the winter months. The heavy tides accompanied with the Pacific storms, high winds and waves at this time of year, move the sandy beaches leaving the gravel beds exposed to the rolling action of the waves. It is in these beds of gravel that the gem material is found.

Some cutting material is nearly always present; agate, jasper, jasp-agates, petrified woods and other petrified materials of organic origin, fossils, jade and many others. You never know what the next wave will uncover for you.

The beds and beaches continue to change fast. Marvelous collecting in a certain area today may be covered with smooth sand tomorrow and a new gravel bed exposed somewhere else as the sand shifts with the tides and currents.

### *Continuous Supply*

The collector never depletes the supply of material as the action of the waves continuously changes the exposed material that has been released from the parent rock. Such a rock or a piece of it is shown in photograph Fig. 2. The stones shown in place in the mother rock are agates up to about three quarters of an inch in diameter. The loose agates lay alongside. Parent rock such as this in which the gem material was formed is exposed to the forces of erosion which wear away the softer rock leaving the hard gems to be carried away by the waves or rivers.

In the photograph Fig. 1 the lighthouse stands on a ledge of such rock. The long finger of rock extending out into the ocean is laden with agate. As these agates are set free from their imprisonment which may have been measured in millions of years, they are at





## HOW BASALT CONTAINING AGATE NODULES WEATHERS TO RELEASE THEM FOR BEACH TUMBLING

the mercy of the waves and ocean currents. They may eventually be tossed upon the beach only to be snatched back or covered with sand before the tourist season starts. That's why our summer visit to the beach yields so little cutting material.

### *What To Look For?*

People always ask "what kind of stones are best?" "What shall I watch for?" There are many answers to such a question just as there are different tastes. Even the throwing rocks, when polished or tumbled have a beauty all their own. The light colors especially with a dark inclusion or a dendrite are always a good bet. Then there is the enhydro, the agate with a quantity of water inside with an air bubble inside like a spirit level. The enhydro is rare but a few show up each year. How long

the water has been trapped within the agate is always an interesting question. It is usually difficult to see what is inside a stone even a wet clear one, even with the sun or a bright light behind the stone. You can polish a window on the stone when you get it in the shop.

### *Where Are The Best Beaches?*

The writer has found cutting material in profusion in hundreds of gravel beaches beginning at Ocean Lake, Oregon extending south almost to Eureka, California. Some of the well known areas such as Agate Beach shown in the photograph page 96, the area just south of Yachats. Beautiful black and white agates are found on the beaches of the inaccessible area between Cape Argo State Park and Bandon.

From Bandon, Oregon south into California be on the lookout for jade,

pink and white as well as green. The jaspers are plentiful from Brookings to The Trinidad Head. The facts are that nearly all beds of gravel especially in the surf should be checked, a little inspection will tell you if you want to search longer.

If beach materials are new to you let me suggest that you stop at one of the many rock shops along the way, look at their stock in trade and ask a few questions about beach agates. From there on you're in gear.

Remember, the winter and spring months are best for the collector—it's cold and damp—it's wet underfoot. Dress for these conditions and you'll have fun. Outside of the desert southwest this is the best wintertime collecting in the western states.

---

### THE GEM

Is there a day that's more inviting,

Or a purpose more exciting,

Than seeking nature's gem stones on  
the beach?

The unequaled thrill of finding,

Approached only by the grinding,

And the luster that man's skill can give  
to each.

Molded in the bosom of creative mother  
earth,

A million years in passing and erosion  
gives them birth,

And leaves them on the shifting sands  
a treasure.

Plain silica or quartzite? What can be  
its worth?

Behold it is no common thing that  
nature has brought forth.

That man may own and carve it for the  
pleasure.

Each gem will some how call to mind,

The truth of life we earn or find,

That guides the seeking soul to more  
abundance;

Truth, crystallized, compact in kind,

The earthy softness left behind,

The gem so well reminds us of truth's  
substance.

Clyde L. Browning



# THE OLD & NEW AGATE BEDS AROUND PRINEVILLE, ORE.

*By Dorothy Ashby*

I suppose that you old timers are getting tired of hearing about our famous Oregon agate beds. I thought some of the newcomers to our large, growing hobby, would like to hear about them, though I will put in a word or two about some new places, for the veterans.

## *Carey Agate Beds*

First, let's talk about the Carey agate beds. The home of the beautiful flame plumes, and also those gorgeous small jewelry plumes. Don't forget the red moss that is found there, also. No two pieces are ever alike. It makes up into very pretty cabochons, and tumbles well. The good part of it is, that everyone has the same chance to go home with some nice chunks, if they just work hard at it and are a little lucky, too. Some of the nicest specimens of angel wing agate that I have ever seen, have come from these beds. Be sure to take along a shovel, a good sharp pick, and an extra good lunch. You might want a couple of sharp chisels, so as to be able to work on some extra good pieces up in the high ledge. Don't forget that there is some pretty yellow moss up there also. We have found it with a little red in it, and it is nice. The little lady who runs these beds has many friends, and I am sure you will agree, when you meet her, and her daughter, Susan, that time was not wasted, when you made that decision to take time out and visit these famous beds. There is a new road being built, and should be nearly finished, when our digging weather starts. Keep your eyes open when you leave Prineville, and see how many deer, rabbits, etc. that you can see. My husband and I have spotted lynx cats and bob cats, also.

## *Friday Beds*

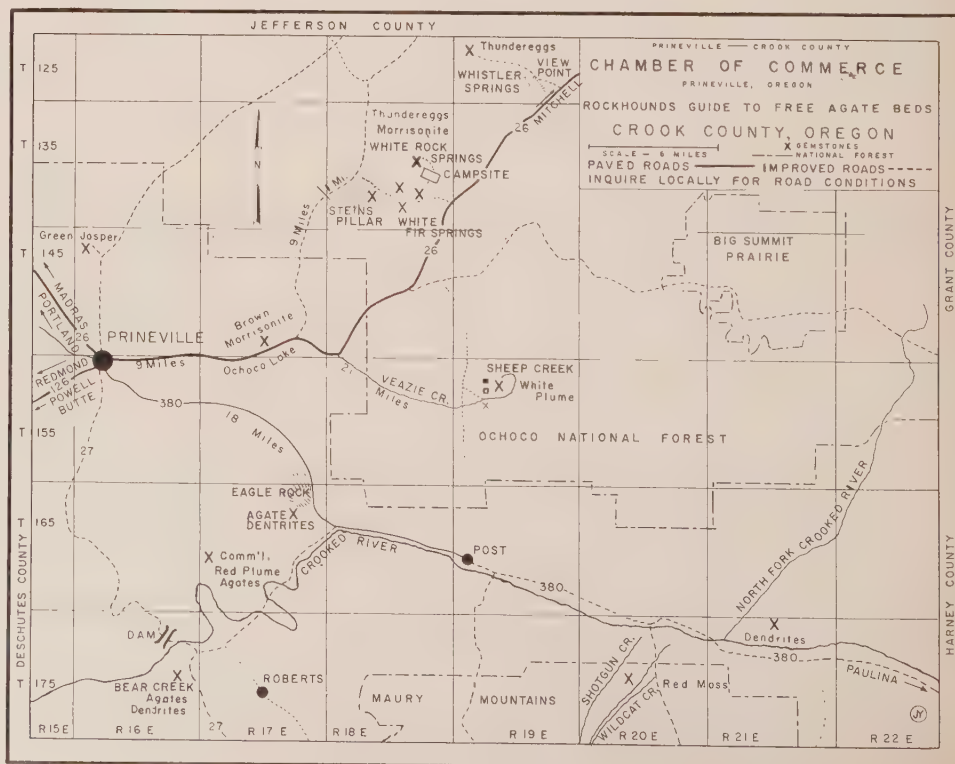
Every one has surely heard of these world famous beds. And is there ever a rockhound who has not a secret desire, for one of those wonderful plume eggs? Sure, it is hard work, but just think of the beautiful moss eggs that you will get, while digging for the plume. Be sure and take a good bar, long chisels, hammer, etc. along with you, as those good eggs are not to be taken easily. They have laid there too many years, and face the light of the world very reluctantly. But what a big shot

you will turn out to be, when you hit the jackpot and holler "plume." Every one in the bed, generally runs over to take a good look and lick. And probably wish that you would go home, so they can try out your lucky hole! One of the friendliest men in the country is Herb Vibbert, the man who runs these Friday Beds. He is well liked by all, and always tries to see that every one goes home with a satisfied look on his face as well as a full bag. While you are at these beds, be sure and take time to go to the Red bed, Blue bed, and the Polka Dot, also. At the Blue bed, you can fill your duffle bag very easily and fast, and have a good assortment of those good scenes and pictures that are found in these eggs, along with a multitude of blue shades. Almost every egg is good, so you won't have to take time to crack them. Just take them home whole and cut in half and polish. You will be glad that you got them and wish you had more. The Red bed is a little harder, but well worth all the work. We have found beautiful red moss as well as plume. And watch for the blue agate

eggs that have red in them. I believe that the Polka Dot is my favorite of the Friday Beds. A digger can chisel eggs out of the ledge, work the rock slide over, or dig along-side of the slide in the dirt. Or be real lazy and just go down the slide and pick up small pieces from the surface. This is one of my favorites to tumble. It always comes out with a wonderful polish. It is always one of the first to get picked. Watch for the nice picture agate in this bed.

## *White Rock Area*

This is a wonderful place to go on one of our real hot summer days. Lots cooler up there and a full bag also. The morrisonite nodules that are found along the road to White Rock are worth stopping for. They are not too hard to dig and come in a variety of shades. You can see the "diggings" from the road. Right at White Rock Springs, you will find one of the best camping areas in these hills. Shade, good water, etc. If you have a Jeep, pickup, or such, you can drive right to the diggings. Otherwise maybe you should hitch a ride as





it is a long walk. Be sure and dig real deep, here. I have seen banded eggs from this area that rival Mexican agate. Mr. and Mrs. Milt Klaus of Prineville have a box full of slices from this place that are beautiful. You will also find carnelian, and nice specimens. Down the main road, you will find the White Fir diggings. There is a commercial bed here as well as a Prineville Chamber of Commerce one. The commercial bed is managed by Bud Stringer of Redmond. He is a very likeable young man and loves to talk "rocks" with you. He has a good collection here in town. He has had a good deal of bulldozing done, so that makes it some easier to dig here. You will find all shapes and sizes of eggs at both these beds. There are banded, moss and plume eggs. Also some red specimens filled with crystals of amethyst and clear quartz. Up the road a hundred yards or so, you will see a well-traveled trail, headed west, to the top of the hill. This will lead you to a fairly new digging of lavender and yellow morrisonite. Some pieces have long fingers of cream color. Bruce Meyer of Bingen was the finder of this agate. He has quite a few beautiful cabs made of it.

#### *Post Area*

There are some places left near Post, where you can find black wood, flowering jasper and various agates. An agate hunter has to get back off of the main traveled roads. We always come back with a few nice pieces. Watch out for rattlers in the summer and ticks in the spring.

#### *Bear Creek Area*

I don't know whether this spot will be available or not after the Dam is finished. It is an old "diggings," but seems to produce good nodules, moss, and specimens. I have seen good plume that came from here.

#### *Eagle Rock Area*

This is about 2 miles off of the Post Road. The most beautiful Angel Wing is found here, if you are only lucky enough to find it. Hunters find different colored mosses, plumes and lendrites, up on the top. We went up this spring and got enough small pieces for me to tumble. I have them in the grit now, and they are looking real good. Some of our friends have been lucky in this area.

#### *Maury Moss from Maury Mt.*

This is a place that has a well beaten road to its door. The Prineville C.C. has quite a few claims in this vicinity. Don't try to drive in when real muddy, sure gets slick. You can find red, yellow, greens, browns, and variations of these colors in mosses. Some dense, and some in water-clear agate. I have seen some plume that came out of here, but

have never been lucky enough yet to find any myself. Some were red, some green, and some were white and cream. It surely was pretty. We have found lots of specimens, some amethyst crystals, small clear ones, large clear ones, and blue agate that has formed in the most interesting shapes. I don't believe that all the secrets of these claims have been probed. There is plenty more for all you rockhounds to look for. There is a little surface digging, but mostly it is in seams and down quite deep, and requires heavy digging tools. Don't be a bit surprised if you run on to a 100 lb. chunk along with your small ones.

#### *Glass Buttes*

Here is a subject that I could dwell on for a mighty long time. You see, I like obsidian. To hunt for, to look at, to work up and to work on. Almost every place that you stop, once you are in the general vicinity is rewarding. Of course, the closer that you stay near the beaten paths, the more common will be the kinds that you will find. The idea is to get off of these paths and to try and find some real rare kind as well as the more common kinds. All will work up beautifully into cabochons, as well as baroques. Look for those elusive rainbows, gold-sheens, silver-sheens, spiderweb, etc. We have gold-sheens that are a close rival to gold stone, silver-sheens that look like melted silver, and spiderwebs that have just the faintest of webs of yellows, and deep orange in a background of translucent blacks. There are pieces banded in maroon and also olive green, that when cut with the bands, have eyes, swirls, etc. We have an amber type that is entirely different. It comes in variations of amber color, ranging from light brown sugar to deep maple syrup. Once in a while some of this has gold and silver sheens in it also. There is a feather that looks as though real small feathers of fuchsia color were intermingled with the black. There are rainbows of every color. Just wait until you chip one of these on a good sunny day. Worth looking it! So many kinds that have never been discovered. The south sides have places that have never been seen by any of us. Have you ever seen the "dried prunes?" Mother nature fixed these all ready for the tumbler. No hammering at all. They are reddish and black, combined, and have to be dug and sifted. Hope I have whetted up your appetite enough, so you will take a trip up to my beloved Glass Buttes. And if you have time on your way back to Bend, stop at the Fife Road, out of Hampton, towards Brothers, and look for a pretty specimen of green or red wood. Most of this has to be dug for now, but it is worth it.

The Sheep Creek area, out of Prineville, is a fairly recent digging area. Take heavy digging tools to this place. It is a white opaque agate with some den-

drites. There are also some plumes. The agate tumbles very well and works up real pretty.

#### *Morrisonite*

The area up by the Ochoco Dam is a much-hunted place. But every now and then, someone turns up some new cave where the brown and tan banded jasper is found. It is also found in the rock slides. But this is no place to look in the hot summer days, as there are rattlers in this area. Hoot Elkins is an authority on this type of agate. He can be found in Prineville, but only in the evenings, as he is a true rockhound. The jasper and the jasp-agate that is found above the Dam, is not given the credit due it. Try some of it and see what I mean. I forgot to tell you that if you get a piece of morrisonite, be sure to cut with bands, as this is what makes all those pretty eyes and swirls, etc.

So much for the old. Hope I have not forgotten too many of them. Now for the new. There is a new egg bed up past View Point. They call them Whistler Springs eggs. There are a lot of these eggs, many colors, shapes and sizes; some with just the cores, all the matrix gone. We have found banded, moss, carnelian, blue and clear types. You do not have to dig very deep. They seem to be a foot or so down. Possibly by digging deeper, a person could get larger whole ones.

The Skaggs blue-green morrisonite-type jasper is a new digging around here. It just opened this last summer, and I never did see news travel so fast. The pieces lay a foot or so under the ground and require heavy digging tools. It seems to have been a seam agate at one time, but is all mixed up in the dirt now, along with a lot of large and small, just plain rocks.

#### *Vista-ite*

This is a new "diggings" that we have been to only once, and we were skunked that time, but the man right next to us, dug out some lovely pieces. Lots of scenes in them. Some were green background and some were tan and some pale cream, but just full of pictures. Mrs. Lawson dug out a good piece and Mr. Bird from Prineville was digging out quite a little, but he was digging further up than we were.

All these places that I have mentioned can be found on a map that the Chamber of Commerce of Redmond and Prineville puts out. Or Elkin's Agates of Prineville or Ashby's Agates of Redmond will be glad to give you directions. We have another new find—Indian jasper. A conglomerate of reds, yellows and browns; works up good. This is found along the Crooked River, across from the Botero Ranch. This about winds up the agate story for now, we hope to have more new finds.



# IDAHO'S DESERT CANYONS for BRUNEAU CANYON JASPER

By "Snake River Pete"

*The author of this article, his first in any publication, feels that the locations of important quantities of gemstone materials belong to everyone, not just a few, and he is willing to share his knowledge of some of them with fellow rockhounds. However he is shy and says that he had rather we did not publish his name, but we do have it on file. He is a rockhound of long experience, and the area he describes here is almost untouched. We hope that those who go there will respect the property rights of the ranchers, which are very often not bounded by fences in that wide-open country, leave a clean camp and do not try to haul all of the gem material away at one time . . . leave some for the next fellow.*

Idaho is a land that is perhaps best known to many as the producer of those big Irish potatoes that are so good when baked. There are a lot of areas in Idaho that were at one time covered with volcanic ash, rhyolite and lava, and have since been subjected to the infiltration of rain waters, gradual formation of brilliantly colored jaspers and jaspagates, and in some instances even precious opal of a type most resembling the White Cliff Australian varieties.

Of all the places in this big wide West of ours, none intrigues me as much as Idaho's desert canyons. I have explored only five out of a possible fifty such canyons which are available, but in these I have found dendritic agate, sagenite agate, purple agate, beautiful picture jaspers of all kinds and a few pieces of beautiful fire opal. Also to be had are beautiful petrified limb sections with vivid colors and grain patterns reproducing nature cell for cell.

The job of pin-pointing any specific spot would be almost impossible, for there are hundreds of unmarked jeep trails used by the cattlemen and sheepmen criss-crossing the desert areas. Anyone going into these areas should first secure the services of a local man familiar with the trails, or have a map showing these many jeep roads. Some of these roads can be covered in a pickup truck, but most of them are jeep trails, where the four-wheel drive will often be needed.

To reach most of these canyons, miles of rocky trails must first be crossed, for this is the country of wide open spaces. Get out a large map of the Idaho country and first locate the Mountain Home Air Force Base, which is southeast of Boise. Turning off of U.S. Highway 30 at that point, you would take Highway 51 south and southeast to get into the desert canyon country of the Bruneau River. Or if you should be coming in from the east, turn off of Highway 30 to the south at Buhl, Idaho and go to Castleford, thence west across Salmon Falls Creek to Balanced Rock. From here a dirt road leads west and a turn takes you southwest in the general direction of the Bruneau River and its canyons. This is

where the local guide will be of great help . . . for out in these wide-open spaces, one of those jeep trails looks very much like the next to the uninitiated, and it is always awfully dry, and a long walk out if you get lost and run out of water or gasoline.

There are rewards at the end of the trail though that will make a trip worth while for the venturesome, especially those who are able to be happy without a tourist court handy, with electricity and running water every night. Camping out is advised if you take along your own supplies of food and water, gas and oil.

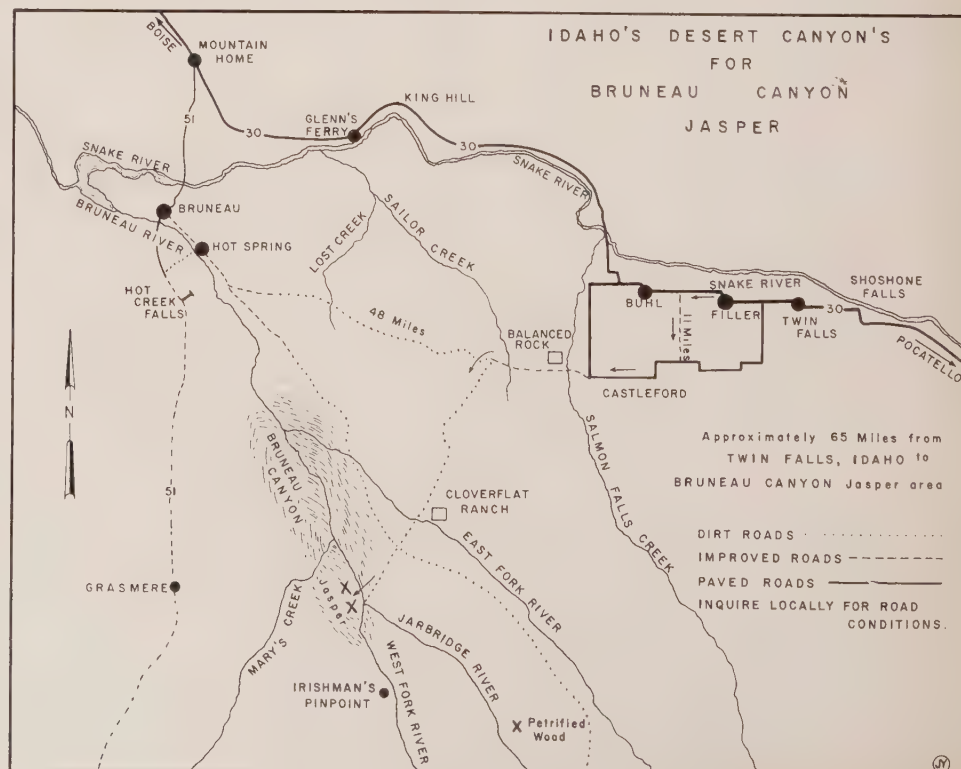
These canyons are rugged, and you will find that to reach some of the areas where gem stones can be found will require the use of a rope ladder, and a rope with a pulley to haul the loot back to the top. Most of the spots can be reached by working along the canyon rim until a spot is found where you can climb down over the rim. No one should

ever go alone into such country . . . too many things can happen.

Some of these canyons were formed by erosion of water and time, but most of them were caused by earthquakes in prehistoric times. When they split the earth, ancient areas of rhyolite and other formations that now contain gemstone materials were brought to the surface.

The best time to explore these canyons is in the fall just before the snow. I have hunted gemstone materials even as late as November. The early spring is another good time to hunt these canyons . . . before the warmer weather brings forth the rattlesnakes. There are quite a few of them in some of the canyons which are away from sheep country. However, in the Bruneau River canyons, I have seen but two in all the times I have been there.

Many of these areas are virtually unexplored because they are practically barren, very rugged and very inaccessible. My first trip into one of these won-





derful canyons was brought about in a rather unusual way. My friend and I were prospecting in the Owyhee River area for petrified wood. We could hear sheep in a distant canyon and decided to go talk to the herder and find out if he had seen any likely spots for colorful material. We should have known better, for most sheepherders are the "No comprende" kind. Either they want to keep things to themselves or they just haven't bothered to take notice. But that day, we really were in luck. We found a big jolly red-headed Irishman herding the sheep who was more than glad to see us. He invited us to stay for stew (Irish, naturally!) and some home brew, and believe me, that is a combination that is hard to beat for a thirsty and hungry rockhound. After the meal, he pulled a small sack from under his bed and remarked "So it's gemstones ye want, is it?" Maybe these will spark yer eye!"

He dumped the contents of the sack out on the big patch quilt covering his bed and stood back for us to look them over. The one that caught my eye first was a gray to blue-gray opal with red and green flashes of fire in it. The stone was about an inch and a half in size and was really loaded with color. Another piece was half of a thunderegg with a white opal center and red bars of fire. There were several pieces of petrified wood with nice colors, and several pieces of unusual picture jasper in the lot.

You can well imagine our feelings at the moment, but it did not take long for our admiration to change to one of curiosity and anticipation. I was on the point of coming right out and asking where they came from, when he brought out a U.S. Geological Survey map and pin-pointed the spot for us. He told us that he had herded sheep in the area about ten years ago and had picked up quite a few "pretty rocks". Through the years he had given most of them away, but had kept these few so that he would have something to remember from that area. The point he had pin-pointed for us was a few miles upstream from the place where the West Fork of the Bruneau River meets the Jarbridge River . . . one of the Bruneau River Canyons. The nearest jeep road to the area was below where the two rivers met.

The next week, we packed up and struck out for this spot, planning to leave our jeep at the point on the trail where we could start up the river, and work up to the site he had pin-pointed for us on his map. Everything would have been just fine and we probably would have found the spot if it hadn't been for the gem material we found as soon as we got down into the first canyon. We have made a dozen trips into the area since, and still haven't gotten upstream more than half a mile. So that spot is still up there, beckoning us every trip. However, the stuff nearer-by tempts us too much each time.

Our first find was one of nodules of

carnelian-colored jasper, with eggs and other designs in the centers. These are a very hard material that takes a beautiful polish. The nodules were all over the ground, and we took our pick and headed back out of the canyon. The next trip down, we walked up the canyon a little farther and found more nodules of a different color. These are close to a black color with red eggs and patterns in the centers.

We shared our find with a few local rockhounds and today there are few nodules left on the ground in that area, but the cliffs are full of them and must be taken out with a hammer and chisel. We decided to explore another nearby canyon called Jack's Creek. We found a jeep road leading to the canyon rim in one spot, but we could not find a way down into the canyon so we walked along the rim until we came to a gully we thought we could get through. We were about half-way down when we found a bed of thundereggs. There were quite a few lying loose on the ground so we broke into one with the rock hammer and found a nice clear agate center with brown and orange blotches of color and fortification designs. The next one we broke open had agate and white opal in the center. We prospected for a quarter of a mile and found quite a few of these beds of thundereggs. Taking only a few from each bed, we headed back out of the canyon. The next day, I sawed a few of mine and really found some dandies with nice lake and sky pictures. I was right in the middle of my sawing operations when the telephone rang. It was my partner, who sounded as if he had just come into a fortune! He wanted me to come over right away, so I jumped into my car and was over there in a few minutes.

He really had just cause for his elation . . . one of the thundereggs had a white opal center with nice red bars of fire all through it. We have sawed quite a few since and have not found any more with fire from that location. There are so many in the area, and we did not keep track of the particular part of the canyon from which that one had come. Some day, we hope to re-find the exact spot, and hope for more of the same beautiful opal.

Another time, we were climbing down into a canyon and found masses of picture jasper in the cliffs. Below the cliffs, we picked up a few nice chunks. This material is the same as the morrissonite picture jasper so well known to many rockhounds. We never did get more than half way down into the canyon on that trip either . . . we just get loaded up before we can get all the way down. We have made numerous trips to different places in several canyons, and have never come home empty-handed.

The most and best of our material has come from the Bruneau River canyon, but we have some fine pieces from Jack's Creek canyon, Jarbridge canyon, Dorsey Creek, and along both the West and East

Forks of the Bruneau River. We have also had some fine picture jasper from Sheep Creek canyon. For the rockhound with a spirit of adventure, I can think of no better place to direct him toward than Idaho's Desert Canyons. There still remains something to explore, something over the next ridge or down in the next canyon that no one else has ever seen . . . that keeps beckoning. I suppose that is why I keep going back.

## OPAL IN IDAHO

There are eight places for opal that I know of here in Idaho, and five of these are well known to local rockhounds. The Mule Springs deposit is good hard gem opal that is almost agate. It occurs in a clay-like material and is located a short distance from Marsing. Go toward Homedale, and turn left at the old "Y" Inn (a cinder-block building that is now empty). Go directly to Graveyard Point. Turn left on the canal road at this place, and go about 2 miles to a bridge. Cross the canal and go back about three-fourths of a mile to the diggings. This opal sometimes contains bars of red, blue and green fire. It is not too plentiful, but it does not craze upon cutting and makes beautiful gems. You may dig all day and not find any at all, and again you may be lucky and dig out twenty pounds with nice fire.

Another deposit consists of small cherry opal in matrix, in a deposit located a short distance from Black Canyon Dam, Emmett, Idaho. From there go toward Horseshoe Bend, you will see a small pond and a few fruit trees on the left side of the road. A trail goes by this pond and to the mouth of a large canyon. Go up this about a mile and you can see the old diggings on the left side of the canyon. These have to be broken out of the rock, which is soft, so that getting them out is not too difficult. The greater proportion of them are red with bright green fire. The largest I have found is about the size of the thumb nail, but their beauty more than makes up for their small size.

Another deposit of opal is located near Marsing, Idaho and is found in a perlite formation. This perlite is full of small pieces of opal, but no one appears to have dug into the formation, which is about 1000 sq. ft. I have picked up several fiery pieces about 1/2" square from the surface. It has all colors of fire but crazes a little when worked unless ground with great care. Deeper digging might reveal material that will not craze, as that near the surface may be weathered.

I have seen several thundereggs with a blue to blue-gray color which have big blotches of fire all through, that comes from some location in the Salmon River country. I have not been able to locate this more closely as yet, but have been told that it comes from a claim filed by a rockhound who lives at Challis, Idaho.



# MONTANA AGATE . . .



A SMALL PART OF THE MONTANA AGATE COLLECTION  
OF BERT C. AND C. M. PEDERSON, BENSON, MINN.



# - - - A Most Fascinating Gemstone

*By Bert C. and C. M. Pederson*

In 1939 we decided to make a trip to the west coast driving from Seattle to San Francisco to see the Fair. In Oregon we happened to stop at a stone shop and saw a variety of colored stones and specimens, which interested us. The manager inquired to find out where we were from and on being told that we were from Benson, Minnesota, he asked us if we had any Thomsonites. We had never heard about Thomsonites and he informed us that they were beautiful stones found on the North Shore of Lake Superior near Grand Marais. It seems that we had to go out to Oregon to find out what we had in our own home state. Since that time we have been up there at least once a year.

We were then invited to see his lapidary shop. He showed and explained the operation of all the equipment, diamond saw, grinder, sander and buff. We became interested at once, acquired some material and equipment on this trip and have been rockhounds ever since.

We have spent over twenty years getting our collection built up and my brother and I have over forty cards each in our collections. We have used about thirty-five diamond blades in our work using 12, 14 and 16 inch blades.

We have cut material of all kinds but Montana agate became our favorite

stone to work on because it has a variety of color and design, making it possible to build a fine collection from this stone. At times we really get a pleasant surprise at what we find—scenes, trees, animals and almost every imaginable beautiful dendritic formation.

We have averaged about two trips or more a year to Montana to get material. The first few years we were able to go out into the hills and gravel bars in the Yellowstone River and would find pretty good material, but those opportunities have become less each year. The areas in which we had the best luck were between Glendive and Miles City and in areas on both sides of the Yellowstone River, all the way from Forsyth to Sidney.

We are members of the Minnesota Mineral Club of Minneapolis, an aggressive and fine organization. They have a show in April each year and many thousands of people come to see the displays. They also sponsored a National Show at the Minnesota State Fair Grounds in 1956.

We have not commercialized on our stone cutting but we can surely recommend it as the most fascinating hobby that anyone can have. Be sure to go into mineral territories when going on your vacation.

## ABOUT MONTANA AGATE

*By James J. Kehoe*

Good Montana agate cutting material is so scarce, people from other states often wonder why, so I will try and give a few of the reasons for this scarcity. Many articles have been written on places to go and hunt it and of varying successes in finding it. Times and changing conditions are the same here as in so many of our large gem deposits through the West. Land scarcity and high prices have caused the Yellowstone valley to boom, and new irrigation projects to make a lot of new farm land, even though there are still large areas in range grass.

After the war the farmers had done so well raising wheat up on the bench country, they built hundreds of dams on the creeks to hold back water for stock. This improved the farms, but it has hurt the washing power of the creeks lower down. So little water has come down some of these creeks since the dams were put in, cottonwood trees have grown up in groves in the creek beds, and these creeks will not wash out much agate now. In other words, conservation does

MONTANA STAINED AGATE





not produce more agate, even though it is good for the area.

The dry and wet cycles over our prairie country are well known, and Eastern Montana has been in a dry cycle since just after the war, so water in quantity to wash out agate has been very scarce. The weather has been warmer than normal in the winters. This has caused thinner ice to form on the rivers, and when the break-up comes in the spring it doesn't plough out as much gravel as it has in years past. I have seen the river ice go out twice with heavy ice 3 to 4 feet thick, and it is a sight you don't forget, with several hundred miles of ice back of it and the big blocks coming end over end at times. It usually jams in places when it is heavy, and when a jam backs up water about 40 feet deep and then lets go, it has real power to wash out and turn over the gravel bars.

The Bighorn river has always brought a lot of water down at break-up time. It is to be dammed up now with a very high dam, so its power to wash will be lost for the Yellowstone in the spring of each year.

When the ice goes out easy, as it has so many of the past 15 years, it leaves mud over the best gravel bars, and this is gumbo mud, so enough said about that. As a warning, don't try the back roads when they are wet or you will probably have to camp out a few nights until it dries out.

After the war, when this hobby became so popular, thousands of people hunted agate in the Yellowstone valley, and large amounts of agate were found. One reason so much was found was that in July of 1945 a cloud-burst poured out about 5 inches of rain in a short time.

It washed the creeks that run into the Yellowstone, and moved complete bars several hundred yards in places. The strip washed was about 40 miles long, and the amount of agate washed out ran into many tons, also good quality.

I hunted there the next year and took out over 2 tons that year, and about a ton the next year. This was not all good cutting material, but I left most clear pieces and jaspers. One nice piece of red banded weighed 19 pounds. Since that time very few good washes have occurred, and those that did were heavy hail and rain squalls that go across the prairie in strips up to a mile or two wide. I got to a creek just after one of these storms had gone by. The creek had raised 4 feet and I found about 100 pounds of agate. In places the bars were all covered with chopped up cottonwood leaves the hail had cut up, and agate was hard to see.

30 years ago I made several trips down the river by boat after the ice went out, and usually covered 200 miles or more. This was a rough trip then, as the wind usually blows a gale out of the North, and it feels like it is right off the North Pole. Eyes water so much, and blowing sand helps this, it is hard to see an agate. Snow storms also help. The radio just reports 4 inches at Billings, and it sounds normal. I was caught out once in a storm that dropped over 2 feet of snow, and I had to wait over 2 weeks for it to melt.

One year I came down by boat, and as camping spots aren't always easy to find I was trying to get to a place I had in mind before it got dark. The ice had jammed above here and had washed a new bar up right in the middle of the river. It was soft and partly mud but

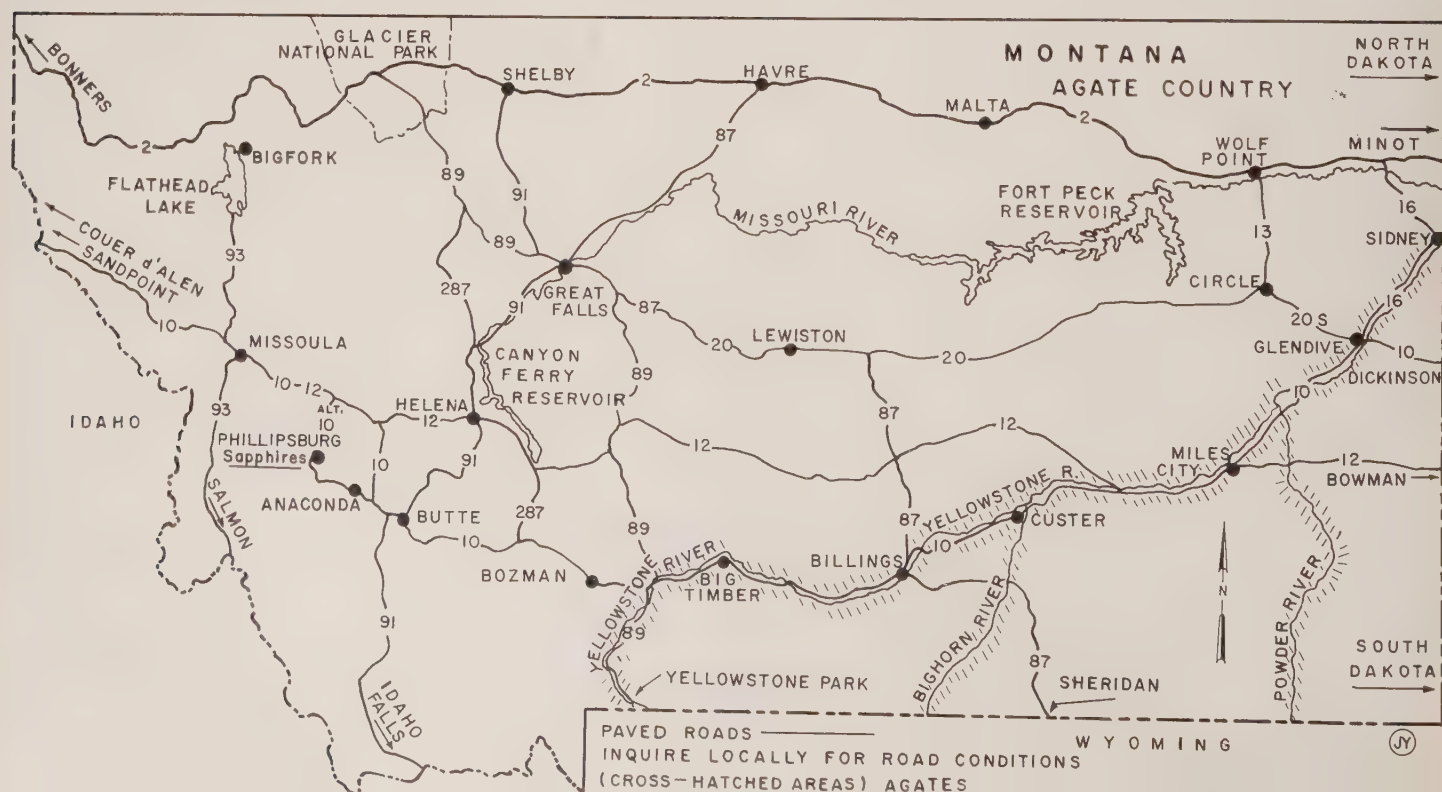
the top was gravel, although I couldn't walk on it. From what I could reach from the boat I found about 40 pounds of very good agate. It was getting dark and I had to get to a place to camp, but I often wondered how many good ones I missed.

Those days we used to find some beautiful scenic agates at times, but for some reason most of the agate found in the river now runs to big clear ones, and not even much good red banded agate. Those days we just drifted down with a row boat, but now every few days someone with a high speed outboard goes up or down and hunts the bars as the water goes down.

One year two other agate hunters heard I was coming down the river hunting, and they put a boat in ahead of me and hunted out about 25 miles of river ahead of me. I pushed them hard and they only found part of the rock. One they missed was a big square-shaped one of about 10 pounds. It was full of black birds in flight from end to end, and I never cut it, and still like to look at it.

The red moss, scenes and sunbursts are the scarce ones, and getting scarcer each year. For some reason this type seemed to crack badly in forming, and then rolling all the hundreds of miles down the river hasn't helped this any. There are some fine collections of these, made by people who realized their rarity in years past. I also have a few. So few are found now it would be hard to make a good collection of them.

The flat-layered or splitter type that sometimes produces large sprays in black or red, are often overlooked when found, as they look so poor outside. If they are set up carefully in the saw, and sawed parallel with the layers, some of



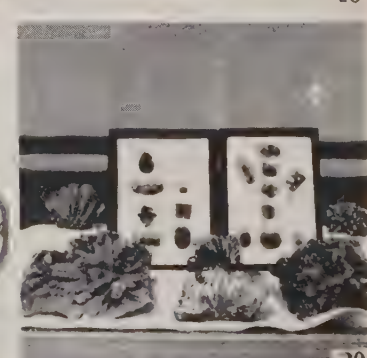
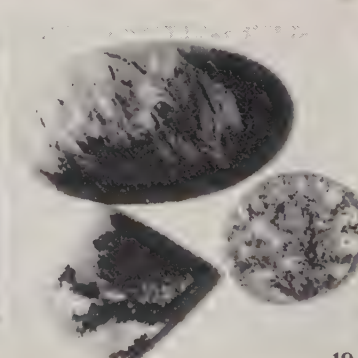
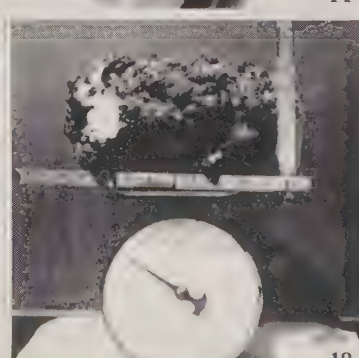
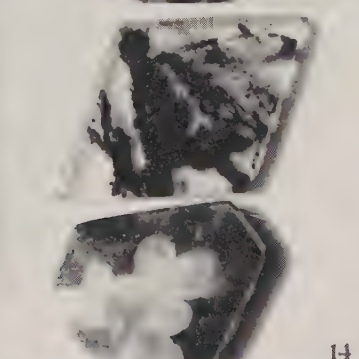
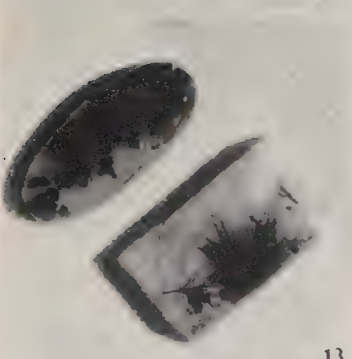
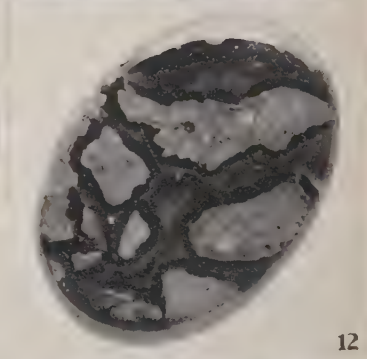
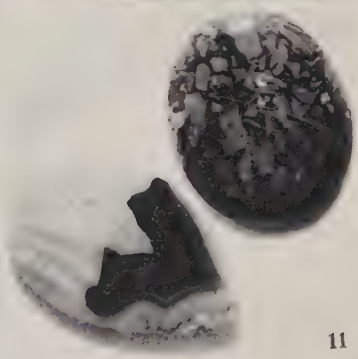
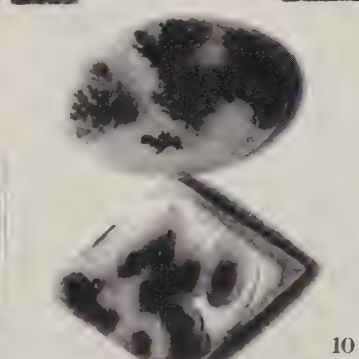
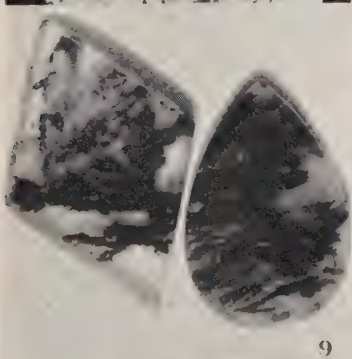
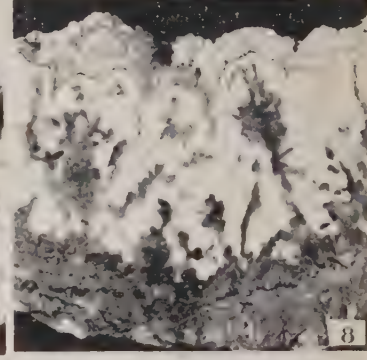
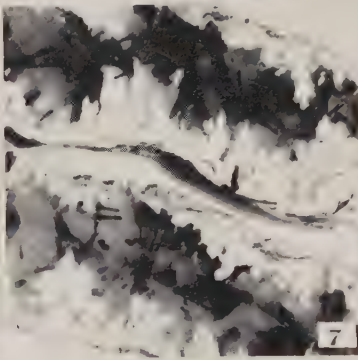
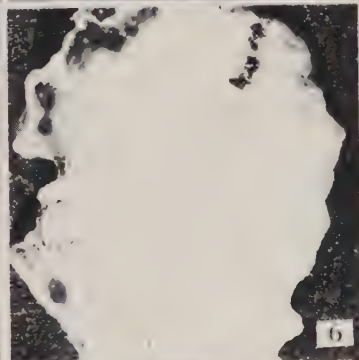
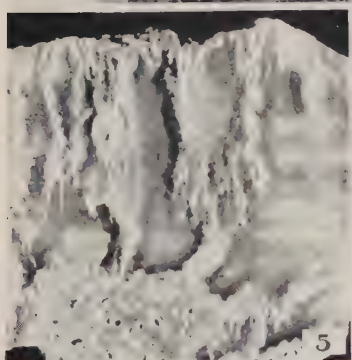
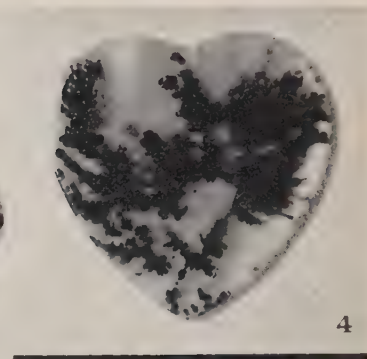
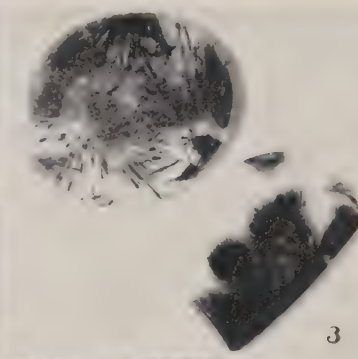
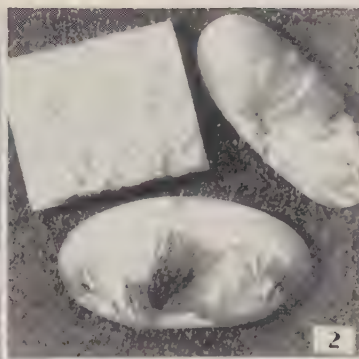
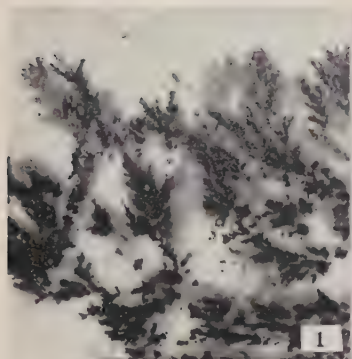






# VARIED AGATE TYPES and

\* \* \* \*





# LOCATIONS in CALIFORNIA

*By Loran E. Perry*

Lecturer—"The Desert In Bloom" and  
other nature subjects.

*All photographs are by the author and are of material collected by  
Rose and Loran E. Perry.*

## KEY TO VARIETIES OF CALIFORNIA AGATE

(opposite page)

1. *Black Plume from Morgan's Well . . . the writer has no doubt that there is some of this material still to be found.*
2. *Calico agate and Agate Hill have been a favorite for years and still yield plenty of good material.*
3. *Graham Pass sagenite . . . there never was an abundant amount of good material here, but the steady worker was well rewarded.*
4. *Black plume in clear agate . . . the Bullion Mountains yielded some very fine examples.*
5. *Horse Canyon moss agate . . . but many types of agate come from this famous location, but it has to be dug for now.*
6. *Agate Valley sagenite . . . plentiful here in the early days, and still some to be had.*
7. *Black sagenite from the Little Mule Mountains . . . the photographer has never failed to find some of this material in that area.*
8. *Lacy agate from Imperial County. The purples and blending whites make this a very fine gem indeed, and it takes a fine polish.*
9. *Gorgeous moss agates as well as sagenite come from the Nipomo area.*
10. *Owl's Head agate is well known . . . some sagenite and plume occur here.*
11. *Sonora Pass breccia . . . and a banded agate. This area demands "in-season" prospecting.*
12. *Brecciated fluorescent geode cab from the Wiley Well region. The variety of types of agate from this area are too numerous to illustrate all.*
13. *Taboo agate . . . the Death Valley area is no longer open to gem collectors because of establishment of a U.S. monument area.*
14. *Cabochons from the Ludlow area . . . this fine area will reward the persistent searcher handsomely.*
15. *Lacy agate from the Mt. Afton area . . . resembles the Imperial County lacy agate, but it can stand on its own merits.*
16. *Agates from Ogilby . . . plus other much sought material, this area yields some fine agate types.*
17. *Chuckwalla Springs agates are varied and gemmy. Many surprises await the hard worker.*
18. *A huge California agate from the collection of Loran E. Perry.*
19. *Lavic gem agate . . . many are the types and great the quantity that await those with the patience to look and look some more.*
20. *Cady Mountain material . . . besides fine specimen material the Cady's yield some good cabochon material.*

This chapter is not meant to be a field trip guide. It is, however, intended to outline the various agate types and general locations in which they are found in the state of California.

To the experienced collector, perusal of the following paragraphs may bring back and cause to live again fond memories of the past—happy days in collecting areas; dreamy hours beside a campfire, or that rare find made in lush fields of gem material that once were. Possibly the younger gem collector's interest will be aroused to a degree that he will seek out some of the locations and the materials mentioned, even if he does need to realize that the days of just "picking up" material in many areas are past, and that hard digging is the price of a full bag now. Some of those "old timers" perhaps did not realize just how lucky they were!

The question invariably arises when collectors get together, whether or not there are any more gem fields yet to be discovered. If so, will these deposits equal in quality and importance, some of the locations that have become depleted over the years? For the answer, the editor called upon gem collectors and experts all over the nation, and some newer hobbyists. They all seem unanimous in stating their position: "Yes, there are many gem fields yet to be uncovered" . . . "Yes, the material that can be found today compares favorably with that the old timers found . . . it is just harder to get it."

All of those questioned agreed that these elusive undiscovered deposits lay farther back up those sandy washes, over the untrampled ridges, farther back in the inaccessible valleys. There is no doubt in the writer's mind that such places exist. Doubtless the strong of heart and stamina who challenge the unprospected regions will be richly rewarded. Those who cast their lot along a long abandoned mine road that leads to nowhere, park the car or jeep, then walk, walk, walk those lonely canyons, those unseen black buttes, will reward you well.

(How true this can be came to light recently in a still-to-be-revealed find of true Fairburn agates, revealed by bulldozer blade in an entirely new location in South Dakota. The Editor is pledged not to tell where, until the discoverer can protect his find properly.)

Now for the agates of California . . . let's start with **Northern California**. Those who have collected material around the **Alturas** region report agate material of lesser denomination, mostly geodes and smaller cherty pieces. A vast number of the rock-hunting fraternity who were questioned agree that Far-Northern California produced lesser types of gems in the agate category. These statements also hold true for the **Modoc** districts, where scarcity of agate material as we know it in Southern California is notable.

**Redding and Paradise**, in Butte County, yield some cherts, lesser agates of gemmy types and some stream agates. Northern California beaches, however, do have some good agates of this type. **Sonora Pass** offers excellent prospects, in season, and it is suggested that this is a region which may yield to closer inspection farther back, in the adjacent canyons, hillsides, outcroppings and ridges. We suggest that this may one day be a prominent source of agate of gem quality. The season is short, for snow covers the ground a great deal of the time, so midsummer, after the "melt down," is the only time to go.

The agates of **Death Valley** are well known. The writer hunted agates many years ago in **Artist's Drive** where very good sagenite was to be found. Other Death Valley regions produce some excellent agate, including banded, sagenitic, dendritic and blue. However, rock hunting is taboo now—it is illegal to take any type of materials from the "Monument" without permission from the rangers and that is difficult to secure. The best hunting for this type of agate is in the rock-pile of some old-timer, if he will give you permission, and "there's the rub".

The **Bean Fields of Nipomo** in San Luis Obispo County are well-known. One must get permission from the owners of the land in order to hunt there now. A vast variety of agate has been taken in Nipomo fields and foothills. Sagenite and marcasite agate are the most prized items there. There's more underground . . . the easy pickings are about gone.

**Lead Pipe Springs, Eagle Crag, Bicycle Lake** have all yielded to those who collected there before the military took over a vast and varied array of



material. The area had been a favorite of collectors for many years. The "honest-to-goodness" blue agate from these regions will long be remembered. The plume, sagenite, jasp-agate and moss were all good material, and plentiful in their day. These areas are closed now, but someday, we can hope, possibly the right to hunt may again become available.

The prize pieces from the **Owl's Head** fields are the sagenite nodules which have been dug up by the more hardy . . . those intrepid souls who have prospected far and wide have often come up with unusual agate of good quality.

**The Cady Mountains**, approachable via Afton Canyon, or via the dry lake north of Ludlow, through Mesquite Spring, yield an abundance of material. Sagenite was the primary aim of many of the early collectors in this area. The author has led many field trips to this area and despite all the material that has come from the region, the possibilities are still there now . . . waiting for the rockhound willing to "go the second mile".

**The Calico Mountains** have been and are frequented by many gem collectors. Some of the writer's acquaintances have been and still are coming home with gorgeous sagenite chunks. The material looks as if it had been dug or broken off of ledges. It is real gemmy and will cut well without pitting. In this place also is **Agate Hill**, a favorite of early collectors. Banded, sagenitic and blue agate were taken there in quality and quantity.

**The Goff's, Siam, Amboy and Needles** regions are yielding fine agates and opalites. Much prospecting will be done here in the years to come. The writer has no doubt that there is a great deal to be uncovered in the back country on both sides of the highway from the Pisgah Crater to Needles. Needless to say, this is Fall, Winter and Spring country . . . not even the forked-tailed one himself would want to be out in that country in the Summer, when the temperature soars, the sun blazes like a molten orange disk in a limitless sky from cloudless dawn to dusk, and even the lizards carry canteens, or burrow deep under a rock.

Another favorite collecting area in the **Bullion Mountains** has been closed by the military, but it may be entered by appointment for the day only, and that in specified areas. Terrific black plume and moss agate, some sagenite and plume were taken here.

**Opal Mountain** gave up a great deal of agate, mostly opalized types, and some jasper and moss agate came from there. It is still a favorite district today, and still yields a great deal of gemmy material for the industrious.

**The Kramer Hills** are not a favorite rock-hunting place, but need not be underrated. One of the best plume

agates we have seen came from this area, and one collector gathered many gorgeous dendritic moss agates in nodules from there. Just a few days ago, an amateur collector appeared at our door with a boxful of agate from the Kramer Hills . . . he didn't know the area was supposed not to be so "hot"!

**Last Chance Canyon** in the El Paso Mountains makes a good field trip. Good agate is hard to come by, but gemmy pieces can be found, and other material make a trip there worthwhile.

Farther East, lie the more favored rock-hunting districts of **Desert Center** — **Wiley Well** collecting region. The writer is a native of that prolific area and can attest to the tremendous possibilities of yet-to-be-discovered pockets of plume, sagenite, banded and pastel translucent agate, lace agates, opalized agates . . . almost every variety you can name. **Coon Hollow** (I wonder how it came by that name . . . no self-respecting coon could ever wash his food around there) has yielded good fire agate in the past . . . and a little more erosion may reveal more.

On our first trip to this place back in the 20's, we were so disgusted because walking was so difficult on account of those blankety-blank agate chunks that we stumbled over everywhere we walked. They were fire agates which covered the ground almost solid for miles south of Wiley Well. The last time we were there in 1960, one man was gathering fire agate with a pair of tweezers and a magnifying glass. Yet they are still to be had . . . those that have yet to be uncovered. It just takes more work.

In the late 1930's some of the earlier rock collectors were beginning to gather geodes from the **Black Hills** and **Little Mule** areas. Those were the days of the Model A Ford, and it took some doing to manage the Milpitas Wash, out of Midway Well.

Probably no other place has so captured the imagination of the California collector more than the great brown hills south of **Wiley Well**. The variety of agate to be had is amazing. All the variations of all the colors are available here. The writer has collected green plume, several colors of sagenite and noted the great possibilities that are even today awaiting the discoverer. Some of the great agate geodes seen there stood several feet high and just about as thick. The large ones laden with black agate and a variety of all the other colors seem to have been hauled away. But there is still a good quality of good cutting agate to be found.

The area south of **Midway Well** contains much surface material. Some of this is good opal-agate of translucent nature. Also, some sagenite and cream-colored agate has been found in the general vicinity of Ogilby. The area has possibilities.

**Afton Canyon** has been a producer of good agate in the past. Most of the gemmy pieces have been picked up, unless one is willing to walk far back. There is much good specimen material to be found there in the back country.

**Lavie-Ludlow** region . . . probably no other region, agate-wise, can quite equal Lavie Station. All is not jasper from here . . . but the writer can show green sagenite, red sagenite and superior moss agate from this area. Nearly all collectors who go to Lavie come home happy. It is a well-known region, yet it has been able to withstand the collecting pressure of thousands and still come up with good material. The same holds true of the hills to the north of the Lavie-Ludlow district. Agate in all its varieties is obtainable hereabout.

**The Tabaseka Tank-Orocopia Fields** are at a new low as I write. They were never prolific of good agate, although some geodes were found nearby, and there were some surface outcrops where geodes might be dug. Here again, the military has taken over . . . be careful to stay on the north side of the old Bradshaw stage road.

\* \* \* \*

Probably no one person knows all of the locations where gem agate occurs in California, and doubtless everyone has his favorite place to hunt rocks. We believe that we have covered the major collecting areas, but we know of a great many more of lesser prominence. This is true of most gem minerals . . . someone may always have his hide-away place that he alone knows about, and about which he isn't going to tell.

The fact that rockhounding started in California much earlier than it did in some other sections of the country and has reached the stage where there are over 150 organized clubs within the one state well illustrates the pressure that has been put on gemstone collecting areas. In many other areas of the nation where there are still a great deal fewer but growing rockhound clubs, this pressure is not quite so evident. However, the fact is that with field trips still on the agenda of almost all of these California clubs every few weeks during the best hunting seasons, there are still areas available to yield a satisfactory return for the time spent is a good omen for the future.

The real thrill for the collector is to get off the beaten track somewhere and find a hidden area all his own. May I suggest: Take an area that looks promising, get out of the car, and walk way back into the back country. If you are not rewarded with gemstone material the first time, eventually you will be. Don't go alone, use the standard rules of safety, especially in the sandy and dry regions in which much of the hunting will be done, and you will enjoy yourself.



# AGATE in ARIZONA

*By Floyd Getsinger*

*Photographs by the author*

Arizona has many agate beds within its borders. Fortunately, these locations are widely distributed, so almost every section of the state can boast of some collecting nearby.

We can start our swing around the state at Kingman. Going south on the Goldroad trail, fire agates can be found about 6 miles before you reach Goldroad, which is now a ghost town. Farther south, about 8 miles before reaching Topock there is agate as well as jasper and chalcedony.

Some very nice banded agate has been brought in from the vicinity of Burro Creek, on the Kingman to Phoenix route, Highway 93.

South of Salome, in the Eagle Tail mountains is an almost virgin area where moss agate nodules, chalcedony, and carnelian may be found. Not very many miles south and east of here is the well known Saddle Mountain collecting grounds. You will have to go back to Salome and take the Tonopah Road, or from the Phoenix area, one would take the Toonpah road through Perryville or Buckeye. Saddle Mountain has been well known to lapidaries for many years, and for that reason has been picked over many times. Large pieces are hard to come by, but every rain washes out new small pieces. Fire agate, brown and white banded agate, desert roses and carnelian are to be picked up here. On the south side of the mountain there is some beautiful white banded agate. Although low in contrast and with just white bands, it makes beautiful cabochons.

South of Saddle Mountain is Fourth of July Peak. Better not try the local roads, but go on to Hassayampa on old Highway 80, then to Arlington 4 miles south. From there take the Agua Caliente road to the peak. You should be able to come up with some very good fortification agate, but you will have to dig for it. Color of the bands is gray to bluish.

North of Yuma, in the vicinity of Martinez Lake are several agate fields. The best of these is on the California side, but some may be found on the Arizona side as well. North of Martinez Lake on State 95 is Palm Canyon. In this neighborhood is agatized wood and palm wood. Palm Canyon is on the west side of the Kofa Mountains, and similar material is also found on the east side of the range.

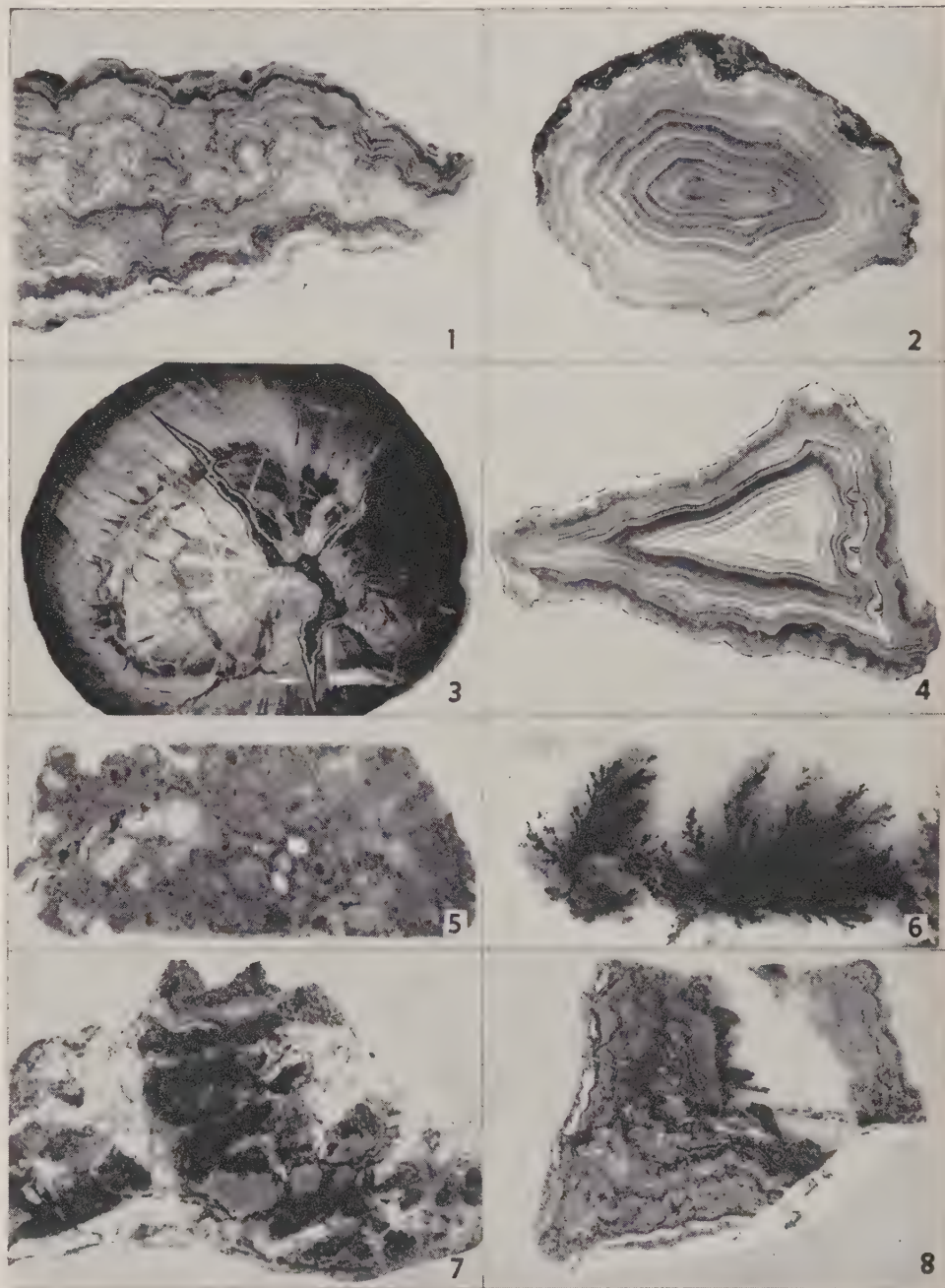
South of the town of Parker is Bouse, and 3 miles north is some very colorful variegated agate.

That takes care of some of the collecting areas in the western part of the state, so let's move on to the southern and southeastern localities.

South and east of Casa Grande lie the Saw Tooth Mountains. You will have no trouble recognizing them, as

their name is very descriptive. Here you will find banded agate in white and gray, also geodes with pink agate inside.

Way down in the southeast corner of the state where Arizona, New Mexico and Old Mexico come together is Guadalupe Canyon. Some very colorful varie-



## ARIZONA YIELDS A WIDE VARIETY OF AGATE

1. Saddle Mountain agate. Colors, white and brown.
2. Fortification agate from Lake Pleasant. Colors, white, pink to purplish.
3. Petrified wood, known as Worthia wood. Colors, black, gray and white. From St. Johns area.
4. Fortification agate from 4th of July Butte. Colors, white, blue and gray.
5. Dendritic agate from St. Johns area. Color, black and white.
6. Red agate with white and yellow spots and markings, from Bolldy Basin district.
7. Variegated agate from Guadalupe Canyon. Colors, red, brown, orange, and light to dark green.
8. Variegated agate from the New River-Cave Creek area. Colors, reds, yellows and browns.



gated agate has come out of here. Colors are red, brown, light green, dark green, and orange.

Miles to the north of Guadalupe Canyon, but still near the New Mexico border is a well-known collecting field between the towns of Safford and Clifton. About 8 miles north from Highway 70 on Route 666 you can go either to the right or the left. The left takes you into what is perhaps Arizona's best known fire agate beds. In addition, there is moss agate and a number of other cutting materials. If you went to the right toward Thumb Butte instead of to the left, there are also agate nodules. The agate is gray to bluish fortification type. There are also geodes.

East of this area, on the east side of State Highway 75 is an area of fire and blue banded agate. Near the town of Clifton are a number of agate beds, but most of this property is privately owned, so local inquiry must be made as to where you may go, if fees are required, or if certain localities are closed to collecting.

Moving back toward the center of the state there is an agate and agate-jasper bed just below Coolidge Dam. The new highway goes several miles to the north, but one can still reach the dam by taking the old road.

Not far southwest of here is the town of Winkelman, but to reach it you will need to go on to Globe on US 70, and then take State 77. In this vicinity are agatized fossils. These fossils create some interesting patterns when the material is cut.

On south from Winkelman is Mammoth, a location well known to mineral collectors. Not so well known is that there is a large area of agate similar to the beautiful brown and white material from Saddle Mountain. Since this location has not been picked over to the extent of Saddle Mountain, large pieces are still available.

Going back to Phoenix and then north, it is only 27 miles out on the Black Canyon Highway (State 69) to Dead Man's Wash. Along the wash and south to Skunk Creek is much pink agate and some lace and eye agates. Color runs from pink to light purple.

Beyond this area a few miles to the north and west is a place called Bard Ranch. In this vicinity may be found plume agate, sagenite, and chalcedony, all good cutting material. Much farther north on the Black Canyon Highway lies Camp Verde, and about 16 miles down the Verde River from there is a bed of multicolored flowering agate.

Returning to New River you will find an un-numbered dirt road that goes across to Cave Creek. There are several places along this road where good variegated agate may be found, especially to the north about midway between New River and Cave Creek. The colors are variegated—red, brown and yellow.

Bloody Basin lies north of Cave Creek, and there are several good agate beds in the vicinity. Purple banded, green moss, red variegated agates, and good jasper can be collected in this area.

Some very nice fortification agate varying from pink to purplish has come from Lake Pleasant, about 35 miles northwest of Phoenix. The area immediately surrounding the lake is now a county park, so some of this territory may be closed to collecting.

Skiping up to the Payson and White Mountain regions, we find some good summer collecting grounds. Agates may be found on the Forest Service road, 5 to 8 miles west of Payson.

Along the fire control road which runs between the Payson-Pine road and Kohl's Ranch is an extensive area of agatized fossils. Many of these are large enough to cut, and they make interesting cabochons. Colors are mostly gray and white or red and brown.

Near the town of St. Johns, in eastern Arizona, a variety of agates are found. Dendritic, plume, and fortification agates of varying colors are common. The beds lie to the east of the town.

Some 40 miles northwest of St. Johns is one of the best known agate areas in the world. A place called the *Petrified Forest!* If you are in the vicinity you will certainly want to visit the park, but don't put any choice specimens in your pocket. The rule here is to take only pictures and leave only footprints. However, there are places surrounding this National Monument where you may be able to collect your own material. Petrified wood is to be found for many miles in every direction.

In the central part of the state on a road between the lively ghost town of Jerome and Perkinsville, is a location of pink agate. This road is not a main route, so inquiry as to its condition should be made in Jerome. West of Jerome, on Highway 80, is a place called Paulden. Three miles west of Paulden there is a field of dendritic agate.

Many of the Arizona collecting fields are on the desert and therefore best for winter collecting. A few are on the higher plateaus and delightful in the summer. One should *always* carry extra water on trips on the desert, even in the winter or on short trips. In the summer never get farther away from a traveled road than you can see. Two people who forgot that rule last summer near Kingman are not around to enjoy polishing agates this summer. Confine your desert hunting to the winter, or in the summer, to the early mornings and never far from a well traveled road. Some of the roads in the higher elevations are closed in the winter because of heavy snows, so collecting there will have to be done in the summer.

We hope you have fun collecting in Arizona. Just remember to leave some for the next time I go hunting.





# HOW I CARVE RARE FIRE AGATE

*By Olive M. Colhour*



*The Woods Nymph, another fine fire agate carving by the author.*



*Lotus Blossom, carved in fire agate*

During visits to several shows throughout the West I was struck by the absence of fire agate on display. Upon inquiry I learned that many rock enthusiasts possess fire agate in the rough. They either lack the knowledge of how to work it, are fearful of trying, or possibly discouraged by former attempts simply because it is not handled quite the same as other agates.

I do not wish to pose as an authority on this subject; but since I have polished a few thousand stones and am at present carving in fire agate, I thought perhaps some of the readers might like to know some of my experiences and practices and possibly a little of the make-up of this tantalizing gem.

The layer of mineral that gives the beauty and fire to the agate or chalcodony is of iridescent limonite or a type of iron oxide. I find that most people fail to realize that the fire layers are trapped between layers of agate and are so thin that they are sometimes less in thickness than a breath upon a window pane. In fact the distribution of fire in the layer is very similar, in-as-much as it has a dense spot in the center, thinning out towards the edges. This dense spot ordinarily is where the best colors are dominant.

In most types—and there are many—both fire and agate layers are built up one upon the other, botryoidal in form. Because of the structure it cannot be handled in quite the same manner as other stones. It is readily understood then that fire agate should be worked with a great deal of caution. I cannot emphasize too much the necessity for study of the stone to be cut or ground before touching it to the wheel or saw.

Let us suppose you have a bubble of fire encrusted with a layer of opaque agate, built up in such a way that you cannot see just how far the bubble of fire extends into the agate. Your only recourse is to grind away the agate until you can see the limits of the bubble. A bubble such as this is the simplest form to work and usually has the best quality fire. This is especially true when the bubble is covered with quartz crystals. Also they are more symmetrical in form and are, for this reason, easier to shape into true cabochon forms, or nearly so.

In reference to shape, you will find that the odd type cabochon is the rule rather than the exception. The more rugged looking pieces consisting of both large and small bubbles en-masse, are much more of a problem. I contour grind all of mine, using the edge of the wheel to remove the agate from between



the bubbles, thus exposing the maximum amount of fire. In this way one can develop much larger pieces almost completely covered with fire. The edge of just any wheel of suitable grit size is not the answer because the size of the wheel has much to do with your success, as well as the time involved.

A large wheel, no matter how careful you are, soon develops a radius too great to get into the crevices. If you attempt to keep the wheel dressed a lot of time is wasted, as well as a lot of wheel. I use a small wheel, no more than a half inch in thickness. By working several stones alternately I find that one of them will usually fit the changing periphery of the wheel. This method also dresses my wheel for me.

I also use a motor tool with a small cut off disk to advantage for removing excess agate in the finer crevices between the bubbles. By improvising small sanding disks, which I cut out, along with the tiny abrasive wheels, which I buy in gross lots, plus numerous other little gadgets easily adaptable to it, it makes it an indispensable tool. Careful use of it enables me to expose fire that would be lost by any other method.

I have always maintained that fire agate should not be sliced. Some of it can be, however; but with definite limitations. You can trim with your diamond saw, rather than grind the surplus agate away. You can also slice the larger pieces provided they are thick enough and have fire well distributed through them. However, this method always leaves me with a sense of loss, regarding the result. No matter how much fire is exposed, I wonder if perhaps the saw didn't take out the best. One must definitely be satisfied with less fire since the saw is bound to remove some; whereas careful grinding does not.

Slicing has its advantages too. Quite often one will expose fire on both sides of a slice, a concave reflection on one side and convex on the other. This, combined with many interesting patterns, readily lends itself to standard working methods, compensating, in part, for the loss of fire taken out by the saw.

Bubbles of fire hidden in the agate are a challenge to me. As a result I seldom slice. I have found that by cautious grinding of a bubble, which has several layers of fire and agate, I can expose different colors. By working the surface layer very thin, I have found that, through light refraction, I get colors nonexistent in a layer.

For example: assume you have a green layer of fire barely discernible below a layer of red fire. By grinding the red layer thin enough a purple hue can readily be seen by moving the stone under a brilliant light, preferably sunlight, while the sides of the stone will still show red and green.

It should be called "sun agate" because only sunlight will show all of its

*Here is the story of fire agate and how to work it. One of the most beautiful of gem materials, it almost defies lapidary treatment and certainly it defies photography because of properties similar to the opal. The author has done remarkable work with this medium and her little portraits in gems of fire agate have been the hit of several of the western shows.*



*Female oriental dancer (above) and male oriental dancer (below) carved from fire agate by the author.*



*Probably no amateur lapidary in America has received as many honors during the last two years as the author of this article on another of her methods of working fire agate. Mrs. Colhour has acquired ribbons and special awards in all sections of the country for her miniatures in this unique material, that defies the skill of most lapidaries. Photos are by her son, Ray Whelpley.*





*The Bride. Carved in fire agate by the author.*



*A carving in fire agate entitled Chica San.*

hidden beauty. I work every phase of it in bright sunlight, which accounts for much of my success with fire agate. For the sun's rays will penetrate much deeper than artificial light and expose depth and beauty not found in any other gem.

I have many stones in my collection showing definite little bands of color as well as all the in-between shades that are mingled through light penetration. I know of no other stone that offers more of a challenge to the hobbyist and I know of no other gem that I can, with reason, work out my own color combinations.

I have found sagenite in this stone. It is very rare indeed but beautiful, with its radiating spikes sometimes covered with the iridescent limonite. There is also a type of plume mixed in with fire and agate like little flower shaped tassels in shades of brown, gray, white and mauve tinted; no doubt another form of sagenite.

To be successful with fire agate you must be venturesome and do some experimenting. Sometimes the layer of bronze or gold fire you have uncovered is hiding a brilliant green or red — even chartreuse. Here is where you must use caution. Be satisfied with what you have unless a careful study of the stone proves conclusively that there are other colors more brilliant beneath. The exposed layer may be very thin so make haste slowly.

Fire agate will not tolerate heat, so it behooves one to grind wet and examine often. After grinding I follow up with the usual process of sanding, being more cautious than ever because I sand dry, constantly checking the temperature of the stone by touching it to the palm of my hand. I sand dry because I can observe my progress more readily and not necessarily because I prefer it.

I use close magnification at all times. I hate to admit I am getting old but I know my eyes are not trustworthy where fine finish is concerned so I take no chances.

In the sanding processes you are again confronted with the problem of deep crevices and uneven surfaces. Much of your success with fire agate is due to your own initiative. I can only tell you what I do and you can take it from there.

I have a machinist's drill press, bench size. I cut the head from a quarter inch carriage bolt so that it will fit into the chuck of my drill press, forming a mandrel. By using a nut and washer above and below, with a sanding disk fitted to this mandrel, you have a very effective tool.

I cut the disks from sanding cloth in sizes and grit to fit the need, mostly four inch disks. As the grit wears from the periphery I trim it back, making my disk a little smaller each time. I cut the disks in pairs and glue them back to back. I use a two inch disk of worn material or



canvas between the pair which serves as a stabilizer. Speed will vary with the size of the disks. I do not run my machine very fast as there is too much danger of overheating the agate. I rotate the stone against either surface of the disk (it is running horizontally) and find that it will conform slightly to the contour of the stone which is a good feature. Then too you have the edge of the disk to get into the crevices.

For getting into the deeper and finer recesses I resort to my motor tool, using the same type disks, only much smaller (one to one and a half inch) without a stabilizer. All of the little odds and ends of your sanding cloth can be used up this way. For polishing I use cerium oxide, very thin; and the medium again is the disk, only this time they are made from felt (quarter inch thick) tapered to an edge.

I have also used, with some measure of success, hardwood sticks chucked in the drill. Small serrations up and down the sticks will help to carry and hold the polishing mixture, which should not be too thin.

If you wish to tumble fire agate be sure to remove most of the imperfections and surplus agate with a coarse grinding wheel until the fire starts to show, before putting them in the tumbler. You will be well repaid for your time and trouble.

As I said before, I am still experimenting with fire agate and I learn something every time I work it. Perhaps some of my methods will enable you to come up with "heap big fire; no smoke" unless it be the smoke from a burning desire to do more and more. I hope so.

## CARVING THE SAFFORD ARIZONA FIRE AGATE

Seeing red usually means, for me, that I have found more fire agates good enough to make me take time out from other activities to work them long and hard. Their fascination is something I just cannot resist and their possibilities play on my imagination to such an extent that in order to keep peace with myself I have to succumb. It is then that I see red.

Even at night in my sleep I am picking up or working wondrous fire agates; and this continues until the stones I am working are finished and repose in my treasure chest, with their hidden beauty exposed for all to see. This has happened time and time again. Strangely enough other stones do not affect me this way.

Quite recently I started working on some fire agates I gathered near Safford, Arizona and, bless Pat, I quit seeing red and started seeing green. I began to realize then that this could get complicated.



*A genie with a balancing seal act — all carved in fire agate by the author. This is just one of the many marvelous ideas the author has worked out in this fascinating material from California and Arizona deserts.*

The working of the Arizona material is slightly different from the method used on the Coon Hollow fire agate from California, which I described in the first part of this section. Having had these new experiences, and because of the numerous inquiries regarding fire agate, I thought this might be an opportune time to review the working of this tricky little gemstone.

I will not dwell too much on composition and structure except to say the material occurs in botryoidal or grape-like form. In the process of grinding and polishing, one must follow the contour of the formation. Because of this, it is one of the most difficult and aggravating of all gemstones to work. However, it is more rewarding when finished.

Unlike the California material, which is predominantly red with a mixture of other shades, the Arizona stones finish up with flashing green, gold, some red and quite a smattering of purple. It comes in larger pieces and is more suited to slicing, making it an easy matter to get good quality cabochons with a minimum of labor. It is also more fracture-free than other fire agate I have worked, which makes it well suited for tumbling.

I do very little rough tumbling so my finished tumbling routine is slightly different than that most commonly used, in that I prefer to hand-work each stone, removing all excess material before putting it in the tumbler. Thus it takes less time, less grit, and I have fewer fractured stones. The extra labor pays off since it gives me a chance to shape each stone. This gives me many pairs of baroques for earrings that I would not get by any other tumbling method, and it also lets me point up the best spots of fire that might never show otherwise. This method would apply to all fire agate, regardless of locality.

In all types of fire agate one finds the inevitable white layer of agate covering the brown layer of fire often spectacular. This, of course, must be re-

moved. It requires careful handling to grind away this white layer without losing the fire. Sometimes it is more rewarding to work from the underside and, if successful, one finds a different gem with little pools of moving fire, much rarer than the other type.

Much of the Safford material has sagenite inclusions, mostly white or brown, with an occasional little star of radiating spikes covered with red and green fire, another rarity. Every now and then I saw the top from one of these little stars, exposing its beauty.

Actually I do very little slicing, being content to follow the fire layer I can see by removing the excess material with a wheel. It is much slower than sawing but I save many stones by using this method that the saw might spoil. However the Safford material, because it is in larger and thicker pieces, does not show its fire so readily and can be often sawed advantageously.

The iridescent limonite that gives fire agate its varied metallic colors is extremely thin. It is built up in layers between the agate. If the top layer of fire is lost it is often possible to find more fire by grinding off another layer of agate. However, the surface layers are usually the most brilliant.

I contour-grind and polish almost all of my stones, very carefully following the surface of the bubbles. I first trim off all the crystal and agate that can be safely removed without cutting into the brown part. I use the trim saw to accomplish this, being careful not to cut too deeply. Then I grind down to the fire layer, using a 120 grit, 6" by 1/2" wheel. This size wheel lends itself to this type of work much better than a larger wheel because one can keep it dressed pretty well to shape with the rock one in grinding. I work with several stones at a time, selecting the one that best fits the constantly changing periphery of the wheel, switching to a 220 grit wheel for the final dressing. Quite often my motor tool, with its



flexible shaft and small abrasive disks, is very useful.

With certain clear types of this material, not covered with white agate, and showing by its formation that it has many layers of fire, I have learned to grind the layers in such a way that I get several in-between shades of color through light refraction. The percentage of stones one can do this with is small. It should not be attempted except when working outside in bright sunlight. For best results *fire agate should be worked in full sunlight*. With this maximum amount of light penetration one can discover the depth of fire and the stone's potential worth.

It is wise to spend lots of time looking at a stone before one starts to grind it. Study it from all angles. Use close magnification at all times and do not be afraid to remove the surface layer of fire if you can detect a more brilliant layer beneath. In this way one can learn to blend the colors. Fire agate will heat-fracture very easily. In fact I have had it explode from heat, so check it often.

After shaping the stone as nearly symmetrical as possible, without losing the fire, the back should then be ground flat or sliced off on the trim saw. Now it is ready for the dop stick.

Among the many tools I use to get results is a bench size machinist's drill press previously mentioned. By cutting

the head off  $\frac{1}{4}$ " bolt I have a mandrel that will chuck in the drill. With a nut and washer, top and bottom, all sorts of sanders and buffs can be adapted to this mandrel. I cut 4" sanding disks from speed-wet sanding cloth, glue them back to back, place them on the mandrel, and go to work. They can be used both top and bottom with the edge doing a nice job in the crevices. When the edge loses its abrasive it can be trimmed. I use this same method on my motor tool, with  $1\frac{1}{4}$ " disks.

For polishing I use cerium oxide on a 4" felt disk  $\frac{1}{4}$ " thick, tapered to a thin edge which will get into the tiny crevices. To get into other hollows and depressions I use hardwood sticks similar to dowels. They can be pointed, round or flat. Roughen up the points and soak them overnight in water so the cerium oxide will cling to the wood. The drill press handles these nicely. For symmetrical stones I use the regular felt buff.

I should mention that anyone working at close range with dry grinding wheels should wear some type of mask. Grinding dust may cause silicosis. My motor tool is especially bad for dust. Since I work right handed, the tool's rotation is such that the dust is thrown toward my face. A number of different protective measures were tried before I found a mask that is comfort-

able, light and does not protrude into my natural line of vision. It is the Martindale Protective Mask made of a thin piece of aluminum cut to fit the mouth and nose. It is easily bent to fit the profile and it has a gauze and cotton filter. It gives me the protection I need, for I use this tool a great deal.

I started carving in fire agate a couple of years ago and now have quite a large collection of tiny figures and faces. In the process of carving fire agate I use the same technique as I do for cabochons except that I do not concentrate on the fire but rather on the coloring of the material and its distribution through the agate.

Almost all of my carvings have fire in them; but it can only be seen if they are in bright sunlight. Color and form are the main issue, with fire secondary. I carve them free-hand without much planning, being influenced by the natural color and balance to suggest the finished figure.

Naturally these figures are small, three or four inches high at the most, and very imaginative. I simply carve what I see. In the little cameo carvings, I use both the white agate and the fire. For instance, in carving a Hindu head I use the brown fire layer for the face, using the white agate above for a turban.

Working with fire agate is like reading a book. I find it so interesting that I have to finish it before I can put it down. Perhaps that is why I see red and green fire, even after I go to sleep. But I don't mind if it is in good agate.



A MAP OF THE STATE OF OREGON IN A GEODE

Unknown years before Government surveyors had designated the boundaries for the State of Oregon, Nature had perfected the original outline in the Friday blue-bed thunderegg presented here. Cut in 1948 by E. Everett H. Cain, from material dug in the early days on the Friday Ranch in Central Oregon, it includes the famous seashore that has provided so many agate gems for collectors from everywhere. This once-in-a-million cut was made in a nodule about  $3\frac{1}{2}$ " in diameter, and no further investigations have been made into it. Mr. Cain is a member of the Oregon Agate & Mineral Society. Photo by Thomas Bones.







# AGATE JASPER and WOOD

## *In the Land of Enchantment*

*By Merrill O. Murphy*

*Photographs by the Author.*

New Mexico is truly the "Land of Enchantment" for the agate hunter who has tired of the familiar collecting sites known to the entire rockhound fraternity. There are vast reaches of nearly virgin collecting country stretching through New Mexico. One of these, the Gila Wilderness, is one of the largest such primeval areas in the United States. And there is no doubt that there are agates there.

Throughout the geologic past vulcanism has played a large role in shaping New Mexico, and much of the agate, jasper and petrified wood we find weathers from enclosing masses of volcanic debris. New Mexico, from the Rio Grande westward to Arizona and from Colorado south to Mexico, is dotted with lava flows, cinder cones, and craters. Just beyond the Albuquerque city limits there are three small cinder cones. The Valle Grande in the Jemez Mountains north of Albuquerque is the largest volcanic crater in the world. There are agates, jaspers and petrified woods in abundance through the entire volcanic area.

### NEW MEXICO PRESENTS A COLORFUL VARIETY OF AGATE

—See opposite page

1. Rio Puerco moss agate; 2. Moss agate, Joyita Mts.; 3. Deming fortification agate; 4. Apache Creek agate; 5. Moss agate, San Lorenzo Canyon; 6. Petrified wood, Cerrillo; 7. Scenic jasper, Jemez Mts.; 8. Jasper, Alamo-gorda Lake; 9. Red and green moss agate, Rio Puerco; 10. Moss agate, San Lorenzo Canyon; 11. Petrified wood, Rio Puerco; 12. Snake Skin agate, Grants area; Apache Creek agate; 15. Petrified palm wood, Rio Puerco; 16. Jasper, Jemez Mts.; 17. Opalized wood, Bernardo; 18. Red and gold striped petrified wood, Rio Puerco (The apparent crack is a shadow from lighting); 19. Pendant, Deming agate; 20. Moss agate, San Lorenzo Canyon; 21. Pastel pink jasper, Jemez Mts.; 22. Apache Creek agate; 23. Blue and gray moss agate, Joyita Mts.; 24. Beautiful orange, yellow and white wood, almost transparent; 25. Rich mahogany colored wood, Rio Puerco; 26. Apache Creek eye agate; 27. Apache Creek tube agate; 28. La Bajada Hill agate, with peculiar plaid pattern; 29. Scenic jasper, Jemez Mts.; 30. Jasper, Jemez Mts.; 31. Petrified palm, Rio Puerco; 32. La Bajada Hill agate; 33. Apache Creek agate; 34. Deming agate; 35. White and pale pink plume agate, La Bajada Hill; 36. Red, green and brown petrified wood, Cerrillos; 37. Deming eye agate; 38. Feathery white plume in clear agate, San Antonio (N. M.); 39. Rio Puerco agate.

(All agate on this page from the collection of Merrill and Jerry Murphy of Albuquerque, N. M.)

#### *Albuquerque*

On the West Mesa within a half mile of the city limits you can, in a short time, fill your car with moss agate and petrified wood. I would not advise you to do so, however. The agate is normally rather rotten and filled with innumerable pockets of soft, frothy opalite. Colors run from ivory, white, pink, and black to muddy white and brown. A few pieces can be cut but are not particularly attractive because of the muddy appearance of the agate. The same material can be found in the river gravels along the banks of the Rio Grande.

Wood from this area is uniformly hard opaque material with good reproduction of the original grain. Colors are dark browns, dark maroon, or gray. A high polish is easily obtainable.

#### *Rio Puerco*

It can be truthfully said that if you search long enough you may find almost anything along the wide reaches of the Rio Puerco valley. The variety of petrified woods is astounding. In a ten foot circle you may find modern pines and willows and pieces of ancient tropical palm. Most of the wood is dark colored and very solid. Occasionally, however, a bit of typically Arizona type wood is found. In a few areas clear honey or smoky pieces of wood are found already polished by sand, wind, and water. Such

pieces are always small.

Agate appears in several places along the Rio Puerco and west to Laguna. It is usually tomato red to apricot colored cloud-like moss in a translucent slightly milky background. From this variety it varies imperceptibly through phase after phase to rich red and yellow mottled opaque jasper. Large rounded chunks to fifteen pounds are sometimes found but first sizes are more usual. Cabochon size bits are normally sharp edged shards broken, perhaps by Indians. Sharp slivers of fine agate litter the ground around archaeological sites on the Rio Puerco.

#### *San Ysidro*

Most of the wood in this area is dark brown to grey, opaque and hard. An occasional cut specimen has the wood grain outlined in yellow carnotite. Wood from two small hills in the San Ysidro area is entirely different. It is highly agatized, and bright clear specimens occur in all sizes to twenty foot long logs weighing tons. The outer inch or two of the larger pieces is usually nearly clear with contrasting red, yellow, or brown grain markings. Logs tend to become more gray toward the center. Unfortunately the area of the two hills is on private property and now closed to collectors.



*A field trip on the Rio Puerco.*





Upper left—  
In the uplands of the Apache Creek country.  
Upper right—  
The dry arroyos make good hunting—until it rains.

Lower left—Wonderful camping at Cerillos makes the field trip a delight.

Lower right—A native New Mexican (horned toad) atop a day's find of agate nodules.

#### *Bernardo*

This area is best known for the black and white opalized willow wood that weathers from the arroyo banks in the vicinity. Specimens are seldom of large size but show remarkable contrast and grain structure. The wood from this locality is rather porous and absorbs water readily. The absorbed water freezes and splinters the brittle opal if it is exposed to winter weather. For this reason collecting is best following the summer rains.

The usual array of rather mediocre agate from the Rio Grande river gravels can also be found in profusion in the Bernardo area but little of it is desirable cutting material.

#### *San Lorenzo Canyon*

There are many tons of agate and jasper in the San Lorenzo Canyon and its tributary arroyos. These are red, yellow, white, and brown moss agates and jaspers for the most part although banded and even amethyst lined agates are found. Most of it is vein agate, and the veins can be seen criss-crossing the eroding rhyolite. Occasionally, good nodules are found, but most of these contain an undesirable amount of calcite.

#### *Jornada Del Muerto*

Good agate, jasper, and opalized wood are found along the Jornada Del Muerto (Journey of Death). The Spaniards used this shortcut north from El Paso to Socorro, and they named it well. Many there were who lost their lives to the sun and heat of this waterless land or to the fierce Apache who knew its every water hole as a birth-right. Today, only weather toughened rancheros, rockhounds, and lizards inhabit the Jornada Del Muerto, and it is said that even the lizards carry canteens.

The famous New Mexico carnelian has been collected for fifty years or more from near Engle, Cutter, and Aleman in the Jornada Del Muerto. Specimens found are rarely more than cabochon size, but their salmon and white alternating straight bands make them very attractive. Land owners in the vicinity are not too receptive to rockhounds and carnelian collecting. Too many gates have been left open, too many acts of vandalism committed.

Clear chalcedony filled with fine white plumes comes from east of San Antonio. There is moss jasper and dendritic agate in Mocking Bird Gap, but this area is now included in the White

Sands Missile Range. Black and white moss agate can be found in the Joyita Hills to the north.

#### *Deming*

This agate-rich area includes Lordsburg, Cook's Peak, Hatchita, the Big and Little Florida (pronounced Floreda) Mountains, and the Baker Ranch. The agates found in this vast area are all part of the same formation but differ somewhat from locality to locality. The moss agates, tube agates, dendritic agates, fortification agates, and nodules from this area have been collected for years, and the supply remains hardly diminished.

Moss agate from the Deming area is mostly found as chunks of vein agate weathered from decomposed rhyolite and retaining a white rind of the same material. The moss color is usually an attractive yellow-brown in a slightly milky background. Red and black moss is fairly common too. The pieces may be quite large and may contain red and white fortifications or honey-brown worm-like tubes as well as moss.

Deming area dendritic agate often takes on "wallpaper patterns" of linking red or black dendrites in a milky clear background. Baker Ranch nodules





Left—Gray, blue and white Apache Creek agate.

Right—Apache Creek tube agate.

are usually of the banded or fortification types. Many are hollow and crystal lined; some are amethyst lined, and a very few have opal centers. Agate colors in the nodules may be almost anything, but dark reddish-black, plum, or black and white are the most common.

#### *Rio Chama and Jemez Mountains*

There are places near Abiquiu and Coyote where two thirds of the country rock is agate—and most of it quite rotten and useless. The Pederal Chert, a creamy white to clear vein material spotted and streaked with red flecks, is found in huge cuttable chunks near Petaca. The vein extends for miles across the mountains.

Petrified woods in opaque grays and browns are common in the Jemez Mountains. A jasper in various shades of cream and rich tan and brown is also found in quantity in several of the Jemez collecting sites. Some of this material very closely resembles the Idaho Bruneau Jasper. Other specimens contain scenes or onyx banding. Few jaspers take a polish to equal this material.

#### *Cuba to Farmington*

Jaspers, petrified woods and bone, and agate can be found in many places along Highway 44 between these towns. The wood, bone, and jasper is almost all opaque browns, blacks, and grays. Palm wood may be found, but more modern woods are the rule. Fine white sagenite agates occur in the gravels of the San Juan River.

#### *Grants, Gallup, and Zuni*

There are numerous locations in this general area where petrified wood and jasper may be found in quantity. The wood is usually opaque, and grays are the most plentiful. Some specimens are typically Arizona picture wood; others are the vivid reds, yellows, and blacks so often associated with the Arizona

wood. Black wood with yellow uranium minerals is often found in the uranium mines in this area. A very dense, fine, black wood is found at the southern extremity of this area. Yellow jasper with small black dendritic markings generously sprinkled through it is found near Blue Water.

#### *Ancho*

This area has been known for years as a source of fine red jasper.

#### *Cerrillos, La Bajada, and Santa Domingo*

The river gravels beside Highway 422 contain large amounts of agate, but critical searching is necessary to find the very occasional white and rich brown banded Montana agate type. Strange plaid agates are occasionally found near La Bajada with yellow moss agate and orange opal and agate. A very fine medium red petrified wood, opaque, dense, and hard comes from near Cerrillos. This material is often found in stumps and pieces of large logs.

#### *Pecos River and Alamogordo Lake*

There are tons of vein jasper in the Alamogordo Lake area. Most of it is not particularly attractive, but there are localized areas where mottled brownish jasper with strange Chinese red bandings can be found. Woods found in this area run often to very large size but are usually too granular in structure to cut well. Smaller limb sections of good quality are often found here and there along the Pecos River.

#### *Kingston*

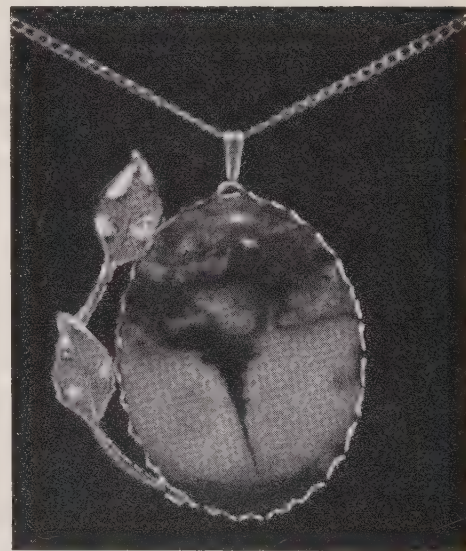
Small amounts of very attractive plum to red and black splashed clear agate come from the vicinity of Kingston. Larger amounts of rough white chalcedony may also be found. Within the past year a Kingston company has begun to advertise Nutt agate for sale. If it comes from the locality for which it is named,

it is likely that the agate is similar to the Deming varieties.

#### *Apache Creek, Luna, and the Gila Wilderness*

The Apache Creek and Luna agates are comparable to the Yellowstone River, Montana agates in their cutting and polishing characteristics. By far the largest percentage of this fine agate is clear with white fortification banding or onyx banding. Lesser amounts are black and white banded. Black or black and white tube agate as well as black and white dendritic material can be found. Luna agate differs from the Apache Creek material only in a marked tendency to have a sun burned yellow or brown very thin rind. Both locations produce gem material from cabochon size to as much as twenty pounds. Larger pieces dug from the ground or from the rhyolite are beautifully blue when cut. They fade if exposed to sunlight for a short time. This agate has a most distinctive rind. Almost all of it shows the perfect imprint of many thousands of well shaped calcite scalenohedrons.

The tremendous Gila Wilderness area I leave to you and to your imagination. A dozen kinds of agate have been found in the unspoiled reaches of the Gila Wilderness. If you are the true outdoorsman, try the Gila Wilderness and find a new location for yourself alone. Be careful, never travel alone, and take spare gas, water, oil and an extra fan belt—good advice anywhere in desert country.



#### **"TEXAS TWISTER" FOUND IN DENDRITIC OPAL**

While slicing a piece of dendritic opal from the state of Texas, Mark Jackson, 2405 33rd Ave., S., Minneapolis, Minn. found the interesting picture of a tornado sweeping its way across the land and named it "Texas Twister." It has been mounted in a pendant and excites comment wherever it is worn.



# Some of the beautiful varieties of





# // AGATE IN TEXAS

*By Hugh Leiper, F.G.A.*

with an assist by Joe Murphy and Frank Woodward.

Since the first writing of "Where To Go In Texas," published in the *Lapidary Journal*, and in revised form in the April, 1953 Rockhound Buyers Guide, little has changed in the hunting of agate in Texas except that at that time there were only a few clubs in existence and a few hundreds of rockhounds. Today there are nearly thirty clubs in the state, and the numbers of rockhounds actively engaged in the hobby have increased into

the thousands.

Therefore, hunting pressure has increased steadily, and the former easily-found deposits of agate are today not so easy. Where agate could formerly be picked up literally by the ton, and was, today one has to get out and really hunt for it. Yet, Texas is still a very large area, and there are still a great many parts of it that have been covered only by a few rockhounds.

Anyone wishing to hunt agate in Texas should first divide the state into at least four large general areas—the Catahoula formation, which carries so much fine agatized wood and palm, starting on the Mexican border near Laredo and swinging in a long curving arc about 100 miles inland from the Gulf of Mexico, all the way through and into the State of Louisiana around Leesville; secondly, the long and richly-sprinkled agate areas of

Below—

## SOME OF THE BEAUTIFUL TYPES OF TEXAS AGATES

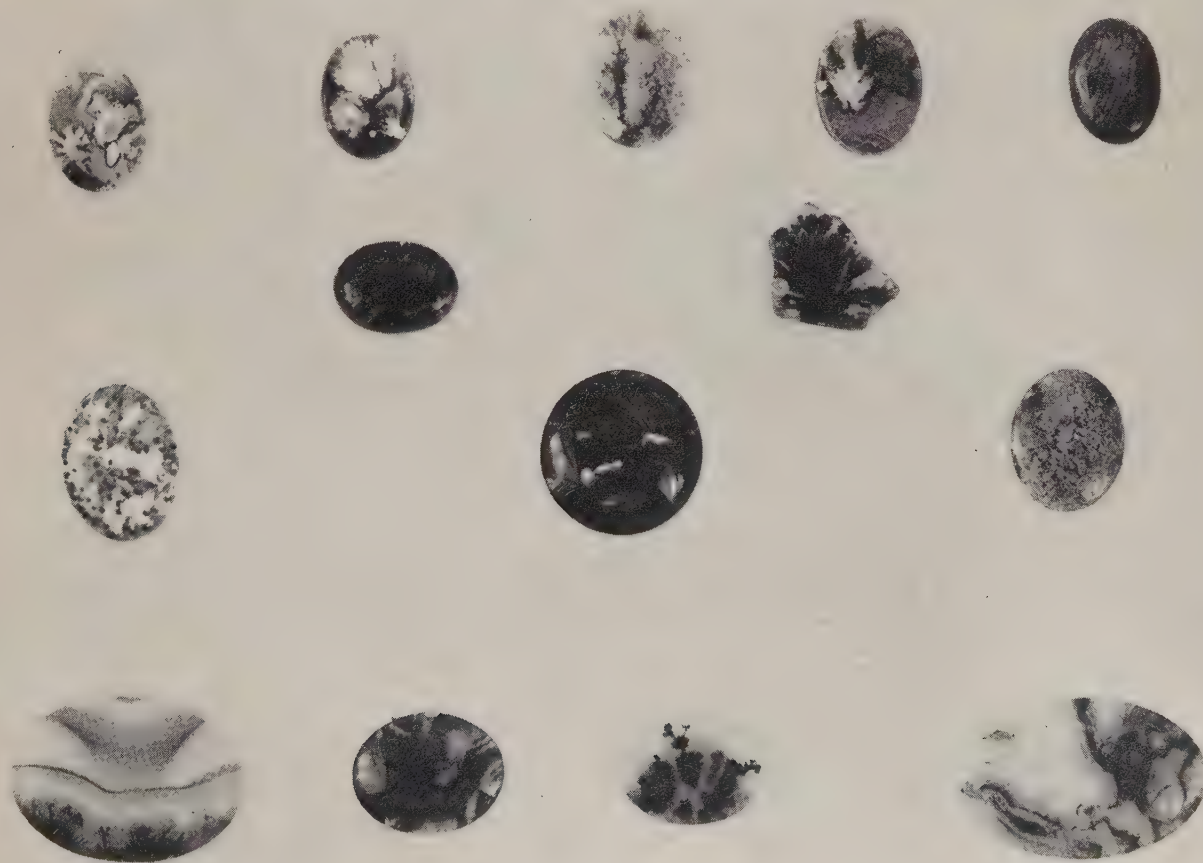
*Top row—Bouquet agate, Marfa, Texas area; white plume in blue agate, Bouquet type, Marfa, Tex.; pink and red plume Bouquet agate, Marfa area; red and yellow plume. Bouquet type, Marfa, Tex.; red palm wood, Cotulla area, Texas.*

*Second row—black lace agate, Balmorhea area, Texas; black Bouquet type agate in clear agate, with perfect "blossoms" at end of stems, Marfa area, Texas.*

*Third row—gray and white palm wood, fortification agate inclusions, Central South Texas; Rio Grande jasp-agate; blue moss, agate, Rio Grande area, Texas.*

*Fourth row—Sagenite in yellow banded agate, Rio Grande area, Texas; red-green-brown agate, Rio Grande area, Texas; Bouquet agate, Marfa area, Texas; Rio Grande agate.*

←—Opposite page — Descriptions accompanying center color spread — See pages 48-49





the Rio Grande Valley, from about McAllen on its lower end all the way up to Del Rio and beyond. Third, largest and most important, the immense area of the Alpine, Marfa and Big Bend portions of far West Texas which have produced the very fine and very famous red plume agates of the Woodward Ranch, the bouquet agate from around Marfa (incidentally, first brought to light by Bob Gault of Agua Dulce, Texas, who first told Andy Burgard about it). This area has also produced the very scarce and beautiful "Pom Pom" agate, with its fine iris and clear turtleback backgrounds painted with clusters of pure yellow bursts, some of which look exactly like daisies, others simulate bushes or individual chrysanthemum blooms. Only two locations have ever been found for this agate, one deep in the Big Bend area is still the secret of the finder, the other is at Needle Peak, south of Alpine, Texas.

This third area starts at about Sander-son, Texas and extends through to Bal-morhea and Van Horn, then southward to the Mexican border. The principal area for the red plume is around Cathedral Peak on the Woodward Ranch about 14 miles south of Alpine, Texas, where an annual get-together and barbecue is held by Frank Woodward and his wife Frances. Many members of the Rollin' Rock Club and others come for hundreds of miles to this barbecue. A giant plume agate found there by the Ehresman's of Los Angeles was pictured in the *Lapidary Journal* for February, 1961. A slice of this agate is shown in this issue, unfortunately only in black and white, which does not reveal the flashing red of its plumes.

Another extremely rare type of agate to be found in the Big Bend area is called "Thistle Agate," and combines wisps of gray and pure white thistle blossoms and foliage with some yellow centers. For delicacy of color and inclusions, this type is very hard to match. Few indeed possess a piece of this very rare agate. One is illustrated in the color center spread.

The bouquet agate found around Marfa, Texas, combines the beauty of white and vividly colored plumes and flower-like "bouquets" from which it takes its name, with clear agate, and deserves the praise that has been given it. Often small, a single cuttable gem may be all that a nodule will produce, but that one piece is quite likely to well repay the seeker for many a "dud." Black plumes, bushes and trees sometimes stand out in snow-white or clear agate. Sometimes the very rare pure blue "blossoms" will be combined with white and clear agate. One such "bluebonnet" agate is shown in a large oval silver mounting on the color spread, and is the property of the editor's wife. Another rare combination contains both plume and sagenite. This material is found generally on the surface, weathered out of the Mitchell rhyolite formations, east and south of Marfa, Texas.

The fourth agate area of Texas is not nearly so important and in fact might almost be eliminated . . . the alluvial gravels that cover the erosion benches of pre-glacial formations in ages long ago, when the great inner basin that then lay between the Appalachian and the western mountains filled the whole central states area up to Minnesota with a vast sea. As this receded, the streams of south-flowing ancient rivers laid bare many agate beds, transported them and intermixed them, so that today, it is not at all unusual to find fluorescent-glowing Sweetwater agates of the Montana type, along with many other agates of the Lake Superior types and many others, in gravel deposits in Central Texas. This agate is actually "where you find it"—no map could be drawn to the deposits. Gravel bars of rivers and creeks are very likely to reveal it almost anywhere except in the limestone-bottomed "black-land area" that makes the East Central portion of Texas such a cotton producer.

The Rio Grande Valley, previously mentioned, is another area quite likely to turn up almost any variety of agate that can be named. The same gravel heap is very likely to yield red, golden, green moss, brown, blue and very rarely purple agate and jasp-agate mixtures to form very beautiful patterns.

Near Laredo, where this agate was first noted, there are eroded pasture uplands away from the river bed which show where some of this agate is coming from, for here the agate lays on the surface and in the washes leading down to the river. The gravel bars in the river bed also yield agate—so much that when the Falcon Dam was being constructed, partly earthen-fill and partly concrete, the up-river face of the dam was actually and literally faced with agate boulders to resist erosion. This agate had been dredged from the river bed and was washed and sized for uniformity. The discard, returned to the up-river basin, was largely oversize agate and jasp-agate nodules. Unfortunately, it is today under at least a hundred feet of water.

The Zapata area which once yielded some very fine agate was partly covered by the rising waters of the Falcon Lake created by the dam, but there remain areas back from the present shore line where agate can still be secured.

Much of this agate was formed up-river in the Big Bend of Texas and over in Mexico. Many, many years ago, the Rio Grande was a huge river, probably equal to or larger than the Mississippi River. In its raging torrents, it brought down the agate and rolled it for many hundreds of miles. It has been picked up as far up the river as storied Langtry, where Judge Bean administered "justice" as the "Law West of the Pecos." Years later, when the great river receded, the lowlands were raised to form the present low-lying hills which now carry some of this agate.

Every type of agate is likely to be found—red and green moss, sometimes in the same nodule, and of large size; banded agates; dendritic agates of true Montana types; red and black plumes; iris, sagenite, tube and a host of other kinds . . . all intermingled with so many thousands of yellowish jasp-agate nodules that one literally gets tired just picking them up and discarding them. The bag gets too heavy if the seeker yields to temptation and keeps the less attractive types. In one thirty-minute session on a washing tower at the Falcon Dam, the author picked an apple box of varied types off the screen—and could have as readily had a dozen boxes. There is still an immense amount of agate hidden in the gravels of the Rio Grande River Valley.

#### *The petrified woods and palm-woods of Texas*

Probably nowhere else in the nation is petrified palm-wood so available as it is in certain areas of the Catahoula formation where it has been brought to the surface by geological shifting. In some areas, the beds of creeks can be found where the entire "onions" of palm roots and trunk still show at low-water periods, if one knows how to look for them. One professional wades such areas in his bare feet, and he has been very successful, as his rock-yard testifies. Areas are known also where entire trunks of large trees weighing thousands of pounds, are visible in the side-walls of eroded creeks. Palm trunks of small diameter, broken into sections, and almost invariably flattened to a pointed oval shape are quite often seen.

The larger portion of this palm-wood is mostly gray with white contrasting pores, but sometimes trunks with black center and white pores are found. Others are various shades of brown and red where they have been colored by the oxides of iron in the soil. Some white, red and golden are to be found, among the latter a find some years ago of beautiful highly opalized yellow-orange wood near Huntsville, Texas. The belt starts near the towns of Cotulla, going through Tilden, George West, Three Rivers, Whitsett, Falls City, Gonzales, La Grange, Flatonia and Huntsville, into Louisiana. Once in a while some very fine and quite rare bright red palm-wood with finely agatized structure is found that takes a superb polish.

The "onions" with gnarled root structure are prized, for they sometimes yield slabs large enough to make small table tops or decorative slabs for pen stands, etc. Some of these are very beautifully colored. It is of interest to note that throughout a portion of this area where the palm-wood and other silicified woods occur, there is also a certain amount of uranium in the country rock, resulting in highly fluorescent slabs when they are sawed, polished and exposed to the ultra-violet light.



# WE FOUND "THE END OF THE RAINBOW"

*By Mellie and Melvin Ehresman*

This vacation and rock trip was a six year dream that finally came true. Six years ago when I visited my kin-folks, an Uncle and Aunt, Mr. and Mrs. Hamp Byler at Balinger, Texas and my cousin Waynie and her husband Arthur Doose, Jr. at Goldbusk, Texas I "talked rocks" and got them interested in the subject . . . and believe me to get a rancher to leave his ranch and sheep in a neighbor's care, to take me from Goldbusk, Texas down to Alpine, Texas—as they put it, "just to pick up rocks," took some pretty tall talking even for a former Texan, but I did it. We drove down to Alpine, Texas and met Frank and Frances Woodward of the famous Woodward Texas Plume Agate ranch. They made us feel so welcome and right at home . . . showing us what to pick up . . . and where to go. At that time, Frank said every time he went to milk the ole cow he dern near had to "squat" on good agate!!! As a consequence I shipped home 180 pounds of good agate and my husband, who had to stay home that year, liked to have flipped his wig when he received it, but later, just like a man, said "why didn't you ship more?"

We work for T. F. Virgin of Frantom Lapidary Equipment Co. and our vacations have frequently been in the season which is too hot for rock hunting, August . . . So when our boss, who along with his charming wife Frances Virgin, is a rockhound and to whom I had been talking up a storm on going on a rock trip to Texas, took pity on us and gave us our vacation in that beautiful month of October, it was the beginning of our dream come true.

We took off the fourteenth of October on the most glorious adventure of visiting rock shops . . . seeing beautiful scenery . . . finding rock . . . and just plain having a wonderful time with two whole weeks just to tizzy tizzle . . .

The weather was wonderful . . . it rained on us all the way from Wickenburg, Arizona to Van Horn, Texas!!!! We didn't mind . . . warm car . . . good radio . . . seeing the sights . . . we made wonderful time . . . didn't push too hard . . . visited my kinfolk . . . got them all "shook up" on the rock subject again . . . visited the Texas Long Horn Caverns . . . visited Brackenridge Park at San Antonio . . . then swung onto Highway 90 through Uvalde, Del Rio, Sanderson and on to Alpine.



*85 pounds of Texas Red Plume Agate*

We pulled into Alpine the 23rd of October . . . found a good motel . . . had a good supper and hit the sack . . . up bright and early . . . good breakfast then out to Frank and Frances Woodward's ranch which is about sixteen miles south of Alpine. They were surprised and very happy to see us for we had been promising to visit them for a good long six years and they had just about given up hope.

Frances served some of her good coffee . . . we talked . . . what else . . . of course rocks! So Frank just gave us the run of the ranch and told us to just go wherever we wanted . . . so we

headed for my little secret place that I was in six years ago!

There were a few dark clouds scudding across the sky here and there but being a Californian (adopted) I didn't pay too much attention to them. Mel and I just drifted along picking up good material and talking . . . soon we came to a good size ridge . . . he with the instinct of an adventurer said, "I wonder what is on the other side of this ridge?" . . . After a few zillion rock trips with him I knew he wanted to go and explore . . . so I said why don't you see? He did . . . I kept to the lower level and soon he was out of sight. . . . I began



to find some beautiful plume so I yelled, no answer . . . so I kept walking and picking up rock . . . soon both my bags . . . my pants pockets . . . the pockets on my jacket and my hands were full of rocks . . . then naturally I found a big one with good black plume in it . . . so I tried yelling some more . . . yoo hooing . . . crow calling . . . and I began to burn just a little I couldn't leave the big one so I had to rearrange my bags to accommodate all my rock. It took a little doing but I had a couple of bulging bags I tell you.

In the meantime the clouds were getting a little darker but I still didn't pay too much attention to them . . . I picked up the big rock and trudged over to the next hill . . . I put my bags down and sat down to have a good cigarette . . . then I made a revolting discovery . . . one match . . . so some gusty little winds had to crop up . . . but I waited and lit up during a lull . . . then I saw blood on my hand . . . couldn't figure out where it was from, and upon checking found a good cut in the tip of my thumb . . . I apparently had cut it on a sharp edge of the rock and had not noticed it. I fished in my pockets for a tissue—ordinarily I would have half a box crammed into my pockets somewhere but on this particular occasion I didn't have even one!! So I had to bleed like a gusher. I sacrificed my cigarette and put the paper to the wound, sufficient to say it didn't help the cigarette any but it stopped the bleeding, then to add to the situation those dark clouds figured this was the time to dump their water. They did . . . boy! It didn't rain very long but what it didn't make up in length it made up in intensity. I ducked my head in but it didn't do much good, this plus the very fact that I didn't have a match so I was having a "nicotine fit." All this put me in a good humor . . . one for murder, so I tried yelling for Mel again . . . same results . . . no answer, bless his little adventuring heart. So I figured that as loaded as I was, I would just leave my bags and just explore. I still had my pockets empty but not for long . . . I kept walking and picking up beautiful rock . . . then the clouds emptied again . . . but soon the sun shone through brilliantly and my eyes were attracted to a rock that just glistened in the sun . . . I walked over to it and couldn't believe my eyes . . . I got down to look at it closer . . . it was full of beautiful red plumes. I couldn't even budge it . . . so I decided to go back to my bags and get my rock hammer and take a sliver off it to see if I wasn't dreaming . . . so I turned around in what I thought was the direction I had drifted . . . by the way the grass in this particular spot is knee high . . . so I looked . . . no bags . . . then I really started looking for them.

No bags . . . No Mel . . . NO cigar-



AN 8" x 10" GIANT SLAB OF TEXAS RED PLUME AGATE

*This tremendous slab of rare red plume agate was one of a number cut from the large Texas red plume agate shown on the opposite page. It was found by Mellie and Melvin Ehresman, of Los Angeles, on the Woodward Ranch near Alpine, Texas.*

ette . . . finally I spotted my bags . . . got my rock hammer and started back to The rock . . . you guessed it . . . no rock . . . by this time my disposition was something between a teed off panther and an old she bear with a sore paw, so I started over in the direction I had taken in the first place and there it was . . . so beautiful . . . how had it been passed by . . . why hadn't any one ever seen it . . . these thoughts ran through my mind. Then I gave a little prayer of thanksgiving for allowing me to find one

of Nature's masterpieces . . . to have the joy of enjoying its beauty. I marked the spot and went back up to my bags which were about fifty feet away. I sat down to wait for Mel . . . soon I saw him coming down over the hill loaded . . . I gave him just about time to reach me and lit in on him . . . poor man, didn't know what hit him . . . then when I got my breath I asked for a match . . . told him my tale of woe . . . had my finger looked at and sympathized with and my feelings soothed as only a sweet husband



can . . . then I told him I had a surprise for him. I took him over to the rock, and he just couldn't believe it! The next problem after looking at it was how to get it back to the car which was a good half mile away . . . what about the four loaded bags plus the ones I had piled up while wandering around? Well, we loaded Mel up with three of the bags . . . two on his shoulders and one on his back . . . and I waited by The rock . . . while he took those to the car . . . he came back with a gunny sack . . . the first good indication of the weight of the rock was when he tried to lift it and grunted. We had to knock off some of it to get it into the bag . . . then next problem how to carry it . . . Mel's solution was to get it up on his back . . . we did . . . I don't know how but I can tell you he almost walked on his knees and bent over double for that half mile back to the car . . . we put it down and rested only once . . . I had the other bag and rock hammers and so forth . . . so that little rest felt good . . . then up with the rock on his back and this time on to the car . . . Never did it look so good . . . when we had rested a little bit we then went on back over to the ranch and called to Frank to come and see what we had found. He helped us get it out of the bag and up onto the bench where he washes and grades the rock . . . he started to wash it off . . . he took one good look . . . buried his head and said . . . Oh, no . . . Oh . . . no . . . then he started yelling for Frances . . . and asking where we had found it. True to good rockhound tradition . . . Mel pointed in one direction and I pointed in another!!!! Believe me there were some very excited people . . . weight, eighty-five pounds . . . length, 17 inches long . . . width, 14 inches wide . . . height, 9 inches . . . thick 95% plume . . . showing are red plumes about six inches long . . . According to Frances and Frank this one is the finest plume agate to ever come off their ranch.

We weighed the agate the next day and found that in a day and a half we had collected 350 pounds of good agate a good percentage of it plumes . . . red . . . yellow and black. So with no overload springs we figured we had better tippy-toe back home. We left Tuesday, the 25th, for home . . . a wonderful trip under our belt . . . some outstanding agate . . . The rock . . . old acquaintances renewed . . . and completely happy.

Thus ended a wonderful six year dream . . . complete fulfillment away beyond our wildest dreams . . . I want to say in closing . . . if a person will walk . . . look . . . and explore . . . and go just a little further . . . that there is no reason they can't come home with plenty of beautiful material like we did.

# CAN YOU TOP THIS?



## THE CARNIC AGATE, WEIGHT 1660 POUNDS

*Shown behind the agate are the finders: Lew Carswell, left, Andy Maksymchuk, Dave Nickeforek and Doug Holmes. Carswell and Nickeforek, partners in the Carnic Rock Shop, Vernon, B.C., first located the agate mass while scouting for a field trip.*

## -- 1660 pound Canadian agate

*By Lou Carswell*

The huge mass of agate pictured on this page was first discovered in March, 1961 by Lew Carswell and Dave Nickeforek of the Carnic Rock Shop, Vernon, B.C.

They were guiding the Vernon Lapidary and Mineral Society on a field trip in the Kelowa area, but on arrival, found the ground to be worked was covered by a foot of snow. The club members thought that working under these conditions would be impossible and decided to return to Vernon.

However, the two guides, Carswell and Nickeforek decided to stay behind and "scout out" the area for a later trip when the weather would be more suitable for rockhounding. After an hour or two of ploughing through the snow, they were rather winded and sat down for a rest. The only suitable object protruding above the snow on which to

rest was a large boulder. As soon as they sat down upon it, they were amazed to discover that the "boulder" was one huge mass of agate.

Moving it at that time, without equipment, and in the slush of winter-clogged roads was out of the question. So for a month, they kept their find to themselves, anxious lest any one else should stumble on it by chance.

Upon arrival in Vernon, they arranged to have the entire load, truck and agate weighed on a government-tested scale. Then the agate was unloaded at their shop and the empty truck was again weighed. To everyone's amazement, the difference was 1660 lbs., the weight of the agate. It stands approximately 40" in height, 40" wide and 25" deep. It is now on display at the Carnic Rock Shop, 3411 35th Ave., Vernon, B.C. The owners believe this to be the largest known single agate in North America. No attempt is planned to cut it up into pieces.













### KEY TO COLOR DOUBLE SPREAD, ON PRECEDING PAGES

- |                                                                                                                                 |                                                                                                                          |                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| No.                                                                                                                             | 22. Banded agate, Big Bend, Texas area.                                                                                  | 39. Carey plume agate, Oregon. From the collection of Dorothy Ashby.                                       |
| 1. Bouquet agate, Marfa, Texas area. From the collection of Frank Woodward.                                                     | 23. Plume agate "Cactus Blossom," Marfa, Texas area. From the collection of Hugh Leiper.                                 | 40. Carnelian, California. From the collection of Leland Quick.                                            |
| 2. Red plume agate, Woodward Ranch, Alpine, Texas.                                                                              | 24. Large "Pom-Pom" cabochon with blue and green ground. Big Bend, Texas area. Collection of Hugh Leiper.                | 41. "Chevron" in red and brown Montana agate. From the collection of Hugh Leiper.                          |
| 3. Pastel plume, Marfa-Alpine, Texas area. From the collection of Frank Woodward.                                               | 25. Black plume agate, Balmoreha, Texas area.                                                                            | 42. Chrysocolla agate, Globe, Arizona. From the collection of Leland Quick.                                |
| 4. Carnelian banded agate, Big Bend, Texas area. From the collection of Frank Woodward.                                         | 26. Blue chrysocolla, malachite in agate, Miami district Arizona. Collection of Leland Quick.                            | 43. Striped agate, California. From the collection of Leland Quick.                                        |
| 5. Pastel bouquet agate, Marfa, Texas area. From the collection of Frank Woodward.                                              | 27. Brooch, Idaho plume agate in filigree silver. From the collection of Mrs. Hugh Leiper.                               | 44. Black turritella agate, Wyoming. From the collection of Leland Quick.                                  |
| 6-7. Same as above.                                                                                                             | 28. One of the finest examples of red plume agate, Woodward Ranch, Alpine, Texas. From the collection of Frank Woodward. | 45. Plume agate, Idaho. From the collection of Hugh Leiper.                                                |
| 8. Red plume agate, Marfa, Texas area. From the collection of Frank Woodward.                                                   | 29. Carey Ranch, red plume agate. Prineville, Oregon. From the collection of Dorothy Ashby.                              | 46. Priddy plume, Prineville, Oregon. From the collection of Hugh Leiper.                                  |
| 9. "Pom-Pom" agate, Needle Peak area, Big Bend, Texas area. From the collection of Frank Woodward.                              | 30. Red and green moss agate. Oregon. From the collection of Leland Quick.                                               | 47. Lake Superior agates, Minnesota. From the collection of J. L. Cunningham.                              |
| 10. "Thistle" agate, Big Bend, Texas area. From the collection of Frank Woodward.                                               | 31. Sheep Creek, white plume agate, Redmond, Oregon area. From the collection of Dorothy Ashby.                          | 48. Matched butterfly wings, two pairs, Lake Superior type agate. From the collection of J. L. Cunningham. |
| 11. "Pom-Pom" agate showing two large perfect chrysanthemum blossoms. Big Bend, Texas area. From the collection of Hugh Leiper. | 32. Nipomo sagenite agate, Nipomo, California. From the collection of Leland Quick.                                      | 49. Lake Superior type agate, pair. From the collection of J. L. Cunningham.                               |
| 12. Same as above.                                                                                                              | 33. Montana dendritic agate. From the collection of B. C. and C. M. Pederson, Benson, Minnesota.                         | 50. Lake Superior type agates. From the collection of Rolly's, Sauk Rapids, Minnesota.                     |
| 13. Sunflower blossom "Pom-Pom" agate, Big Bend, Texas area. From the collection of Hugh Leiper.                                | 34. Priddy plume agate brooch, Prineville, Oregon area. From the collection of Dorothy Ashby.                            | 52-3-4-5. Fairburn agates, South Dakota. From the collection of June Culp Zeigner.                         |
| 14. "The 8 Ball," delicate "Pom-Pom" and sagenite in iris agate, Big Bend, Texas area. From the collection of Hugh Leiper.      | 35. Eagle Rock dendritic agate, Oregon. From the collection of Dorothy Ashby.                                            | 56. Rio Puerco moss agate, New Mexico. From the collection of Merrill Murphy.                              |
| 15. "Pom-Pom" agate, Big Bend area. From the collection of Hugh Leiper.                                                         | 36. Marcasite in agate, California. From the collection of Leland Quick.                                                 | 57. Black and red plume agate, Texas. From the collection of Hugh Leiper.                                  |
| 16. "Pom-Pom" agate, Needle Peak, Texas area. From the collection of Frank Woodward.                                            | 37. Carey plume agate, Oregon. From the collection of Leland Quick.                                                      | 58. Rio Grande, Texas plume. From the collection of Hugh Leiper.                                           |
| 17. Same as above.                                                                                                              | 38. Priddy plume agate and dendritic agate, Oregon. From the collection of Leland Quick.                                 | 59. Black Lace agate, Rio Grande, Texas area. From the collection of Hugh Leiper.                          |
| 18. "A bush of chrysanthemums" "Pom-Pom" agate, Big Bend, Texas area. From the collection of Hugh Leiper.                       |                                                                                                                          | 60. Red jasp-agate, Alamo Gordo Lake, New Mexico area. From the collection of Merrill Murphy.              |
| 19-20. Same as above.                                                                                                           |                                                                                                                          |                                                                                                            |
| 21. "Crucifixion," "Pom-Pom" agate, Big Bend, Texas area. From the collection of Hugh Leiper.                                   |                                                                                                                          |                                                                                                            |



# EASY WAYS TO COLOR AGATE

Age old tried and true methods of agate coloring which have been successfully used by the old German artisans and are still being used.

**Preparation and precautions**—Shape and polish agate specimens and cabochons before soaking in chemical solutions. Remove all moisture by drying in warm oven or over alcohol flame. Oils can be quickly removed by boiling in strong solution of sodium bicarbonate. It is important that the agate pieces to be colored be free of oils. Ugly splotches will appear if they are not. All agate will not take color. Only certain types of banded agate, like material from Uruguay and our western states is most suitable. To test for coloring: place polished piece in strong solution of potassium chromate. Leave over night. If it turns yellow, it will take any color. If colors tend to fade due to penetration over a period of time, repeat coloring processes.

**Caution:** Some of the chemicals used in these formulas are poisonous or corrosive. Handle with care. Avoid inhalation of fumes or contact with skin or clothes. Use glass or porcelain containers.

**YELLOW**—Place polished agate pieces in strong solution of potassium chromate. Keep warm and allow to soak about 3 days or until desired shade of yellow is attained.

**BLACK**—Make a medium thick syrup of sugar and water (or honey). Place the polished agate pieces in this sugar solution and allow to soak for about 14 days. Keep in a warm place. Remove from sugar solution without washing and place them in full strength commercial sulfuric acid. Warm slowly to boiling point and boil for about 15 minutes. Keep vessel covered. Remove the agate pieces and place in strong baking soda solution to neutralize the acid. To prevent sweating, soak in plain warm water for several hours to remove any remaining acid in the pores.

**BLUE**—Dissolve red prussiate of potassium in water. Soak polished agate pieces about 10 days. Remove and soak in strong solution of iron sulfate for about 3 to 7 days (depending on shade of color desired). A very dark blue can be obtained by adding a few drops each of nitric and sulfuric acid to the iron sulfate solution. Keep both solutions in a warm place to hasten penetration.

**RED**—Place polished pieces in red fluorescent dye solution—the kind used with plastics for internal carving. Allow to soak for about 4 days. If fluorescent dye powders are used, dissolve in acetone.

**GREEN**—Same as for red, except use green fluorescent dye solution. Here are two more complicated methods of obtaining red and green. These processes have been used successfully by German craftsmen for many years.

**RED**—Soak polished agate pieces in strong solution of iron nitrate for about 14 days. Keep in warm place. Remove pieces and dry in oven or over alcohol flame. While still warm, place in crucible packed in dry sand or fibrous asbestos. Place in oven and heat slowly to about 450 degrees C. Allow to cool slowly.

**GREEN**—Saturate polished agate pieces in solution of chromic acid for about 10 days. Remove and wash with water. Place in air-tight jar containing lumps of ammonium carbonate for about 14 days. Remove and gradually heat in a crucible similar to process in attaining red.

**Additional Notes:** These beauty baths and heat treatments really produce colorful and beautiful specimens and cabochons from agate that is otherwise drab and colorless. Strive to cut the gray banded agate material in such a way that the line designs will show up to best advantage. Contrasting straight or wavy bands cut parallel, vertical, or on a bias will prove artistic. To get a bull's-eye effect, cut slabs parallel with straight bands close together. Grind and polish a curved surface. Many interesting effects can be attained. The skilled lapidary will get a great deal of enjoyment in experimenting with various agate coloring processes. It's great fun having time work for you. Anticipation many times is a pleasure in itself.

61. Rio Puerco orange and red petrified wood, New Mexico. From the collection of Merrill Murphy.
62. Rio Puerco moss agate, New Mexico. From the collection of Merrill Murphy.
63. Jasp-agate, Jemez Mts., New Mexico. From the collection of Merrill Murphy.
64. "Snake Skin" agate, Grants, New Mexico area. From the collection of Merrill Murphy.
65. Scenic jasper, Jemez Mts., New Mexico. From the collection of Merrill Murphy.
66. San Lorenzo Canyon moss agate, New Mexico. From the collection of Merrill Murphy.
67. Petrified palm wood, Rio Puerco, New Mexico area. From the collection of Merrill Murphy.
68. Halved geode, chalcedony replacement of coral, Tampa Bay, Florida. From the collection of Henry B. Graves.
- 69-71. Pair cross sections of coral tubes converted to chalcedony, Tampa Bay, Florida. From the collection of Henry B. Graves.
70. Pair, black and white slices across chalcedony after coral, Tampa Bay, Florida. From the collection of Henry B. Graves.
72. Purple and white Apache Creek, New Mexico, agate. From the collection of Merrill Murphy.
73. Deming, New Mexico agate. From the collection of Merrill Murphy.
74. Purple moss agate with sagenite, Joyita Mts., New Mexico. From the collection of Merrill Murphy.
75. Fire agate, Arizona.
- 76 & 77. Prize-winning bracelet and necklace of fine assorted types, Mexican agate. From the collection of Mrs. Hugh Leiper.
78. Strawberry red and gold sagenite agate, Nipoma, California. From the collection of Leland Quick.
79. Very fine slab of multi-colored Nipomo sagenite agate from an early find. From the collection of Leland Quick.
80. Purple "Crazy Lace" agate, Durango, Mexico. From the collection of William Lyons.
- 80A. Moctezuma agate, Chihuahua, Mexico. From the collection of William Lyons.
81. Same as above.
82. "Bluebonnet" bouquet agate pendant, Marfa, Texas. From the collection of Mrs. Hugh Leiper.
83. Pair, Casas Grandes agates, Chihuahua, Mexico. From the collection of William Lyons.
84. Laguna agate, Oho Laguna, Chihuahua, Mexico. From the collection of William Lyons.
85. Free form silver pendant showing natural map of South America. Laguna agate, Chihuahua, Mexico. From the collection of Mrs. Hugh Leiper.
86. Cabochon of Laguna agate. From the collection of William Lyons.
87. Apache agate from Rancho De Apache, Chihuahua, Mexico. From the collection of William Lyons.
88. Apache agate, (note the similarity of formation showing thin veils of color, same as famous "Hooded Owl" agate on cover). This piece from Rancho De Apache, Chihuahua, Mexico. From the collection of William Lyons.
89. Pair, polished slices Apache agate, Rancho De Apache, Chihuahua, Mexico. From the collection of William Lyons.
90. Coyamito agate from Rancho Coyamito, Chihuahua, Mexico. This piece shows both the fortifications and the aragonite pseudomorph formations. From the collection of William Lyons.
91. Laguna agate from Oho Laguna, Chihuahua, Mexico. This piece shows varying eye formations in addition to the normal fortification lines.



## AGATES OF THE

1.

2

3

4

5

6

7





# CENTRAL SOUTH

*By Ken Kyte*

Nine years ago this Spring, the rockhound bug bit me and a few casual trips to nearby gravel beds proved that there was a world of pretty stones lying about to be picked up and studied. From such a beginning, when the booty of a rock trip was a pocketful of colorful agates and gravel, came an interest in agates and agatized wood that has remained at fever pitch, ever since. Agate materials completely fascinate me. I hope this fascination will never dim. As silicate rocks predominate in this part of the country; these are the kind of rocks upon which I ground my rockhound "eye-teeth".

Agate is a broad and controversial subject. The precise point of difference between Agate, Chalcedony, Jasper and Chert or Flint may be interpreted one way by the exacting minerologist and quite differently by the lapidary or rockhound. In fact a wide variance of opinion exists between rockhounds in different localities. Species of silicate rocks grade into one another so gradually that there can be no tried and true line of demarcation drawn, which is satisfactory to all. Let us take, for the purpose of this article, any rock composed primarily of Silicon Dioxide but not visibly crystalline, having translucency and markings, inclusions, bands, color contrast or odd patterns and call it an AGATE.

## CAPTIONS . . . ILLUSTRATIONS ON OPPOSITE PAGE

1. *Agatized Corals showing different patterns found.*
2. *Crinoid Cast Agates: Stem sections, geode with botryoidal carnelian, and broken specimens showing stem structure on interior.*
3. *Mississippi wood and agates: Center specimen is petrified live oak wood and top center is opal wood with filled in wood-borer holes.*
4. *Various woods and palm from east of Big Thicket area in East Texas. Upper right is black centered wood with thunder clouds and lightning.*
5. *Montana-type agates: Tumbles from gravel deposits near Monroe, Louisiana. Quarter shows size of agate specimens.*
6. *Petrified Wood and Palm from western Louisiana. Lower right is opal palm with pink "straws" and yellow background color.*
7. *Louisiana Banded Agates: Examples of rough, cabochons and tumbles. Agate in lower right shows excellent example of "Ghost-crystal" banding.*

A semi-circle, with a radius of two hundred and fifty miles, whose center is New Orleans will encompass numerous areas where gravel and petrified wood can be found. In addition to the agates we will discuss here, are found Jasper, Chert, Flint, colored and clear quartz pebbles, Oolitic quartz in Chert, Jasperized Fossils, etc. With such a variety of cutting and tumbling material available, rockhunting trips into the Central South part of the U.S. can be most interesting and rewarding.

Here, rock occurrences are confined to river gravel bars, gravel pits and outcroppings of the Tertiary Gravels of Miocene and Oligocene Ages, as well as some gravel lenses in the later Mississippi River Terrace Formations. The Tertiary Gravels are an eastward extension of the same formation which extends across Texas from Falcon Lake to the Sabine River and is approximately one hundred and fifty miles inland from the shores of the Gulf of Mexico. Many rivers and creeks have eroded valleys through these gravel formations and concentrated gravel and petrified wood in stream beds and flood plains. Rockhunting in these water concentrated areas is most interesting and a great variety of material is to be found.

1. *Louisiana Banded Agates:* An agate-like formation, translucent, in various pastel shades, strongly banded, usually of highly irregular shape with hollows, holes, pockets and geode areas lined with quartz or botryoidal formation. Characteristically, white bands of "Ghost-crystal", sharply angular, that are tips of drusy quartz crystals which lined a cavity at one time or another, formed these bands. As many as five or six rows of ghost-crystal bands may occur in one agate, more or less parallel. Such layers have subsequently been covered with more layers of crystals and the whole welded into a solid mass. Some pieces of this material of seam origin can be found. These are beautifully banded, tend to be more solid and lack the holes and other irregularities so typical of the average "nodule".

Ludwig A. Koelnau, 2038 Race St., Philadelphia 3, Pennsylvania, in his article: "The Eye Agate" published in the March 1961 Rollin' Rock Club "Newsletter", describes Louisiana Banded Agate from the minerologist's standpoint: "In the weathering of rocks into soil on horizontal limestone, (Providing that this soil is imported by streams, glaciation or wind; or is the remains, the ruins, of a sandstone formation),

silica is leached out of surfaceal material and deposited at ground water level in spring formation. This occurs just before the imported soil material has been weathered to a Terre Rosa. With the widening of stream valleys, through such an area, this silica cemented rock breaks loose from cliffs and the rest of its Calcium is leached away. Millions of chunks of this material, memorializing Glaciation and Loess deposition, have been rolled along the bed of the Glacial Mississippi and are to be found in the deltaic deposits up-valley from the Late-Pleistocene section. It is banded somewhat like agate, so that to those who think of agate only as a banded cryptocrystalline quartz, it is agate. Such spring formation banding is not Liesgang Banding, (seen in true agates), it is a result of an over-load of silica in water, being precipitated largely as a result of seasonal variations in water supply, on already existing silicate inclusions in weathered rock. It is a form of coalescing crustation by silica and is not Liesgang Banding at all.—In the spring formation, the banding is often inter-layered with zones of montmorillonite or kaolin, cemented with small quartz crystals. Each layer reflects the stage and degree of weathering in the soil structure above. The coloration is entirely chemical, ferric or manganese oxides and clay minerals. There are no inclusions of magma, no breccias of weathered and unweathered basalt, no rainbow or iris agate, no tubes and opal filled cracks."

What does this mean to the agate enthusiast who collects here? Just this: A new variety of "Agate" with unlimited variations and possibilities for cabinet specimens, cabochon material and tumbling pebbles. Cabochons with bands, flower patterns and snow-crystal that will polish and when cut in a high-crowned stone will often show a distinct moon or movable eye of light. To the silver worker and gem cutter who likes free-form stones, slabs of Louisiana Banded Agate are irregular enough to produce any shape, from letters of the alphabet to all the animals of Noah's Ark! Truly an interesting and unusual gem material.

Mr. O. G. Moganos of Jackson, Mississippi, has made several experiments with heat-treating and has discovered a whole range of color changes in this material, at various temperatures ranging from 300°F. upwards through red to white heat. Some breakage in finished cabochons is to be expected. The



writer has made numerous experiments with whole agates embedded in sand and carefully heated and cooled, with little breakage. Color change is evident all the way through an agate so treated. Reds, orange, yellow, pink, salmon, blue and brown may be produced in an agate treated this way or existing colors intensified. Here is a very interesting field for research open to anyone with experimental inclinations.

This variety of Agate, (called Louisiana Banded Agate, perhaps through chauvinistic tendencies of the writer), occurs in practically all deposits of gravel from north central Louisiana south and east through the State of Mississippi. Most specifically in the areas of Monroe, Pollack, Woodworth, Turkey Creek, Watson, Bluff Creek, St. Francisville, Jackson, Amite, Franklinton and Bogalusa in Louisiana. Some areas to check in Mississippi are: Natchez, Brookhaven, Monticello, Georgetown, Gatesville, McComb, Hattiesburg and in northern Harrison County. This banded agate occurs as float in gravel beds and deposits. Good solid material is not too common, though less than top quality is frequent enough to keep the agate hunter's fever at a high pitch.

**2. Lake Superior Agate:** True Lake Superior Agate does occur sparingly in almost any gravel outcropping in Louisiana and Mississippi. For the most part these agates are very small, thoroughly worn, (doubtless from the long journey they have made), and uncommon. Examples with bands, fortifications, eyes and straight onyx-banding turn up now and then as tiny pebbles, pea to peanut size. A few larger specimens have been found in the Monroe, Louisiana area and in a very sandy stretch of Wolf River in the southern part of Harrison County, Mississippi. Lake Superiors are always found as float. The appearance is more glassy, the bands are exquisitely fine and the patterns are more rounded in comparison to the angular banding and more coarsely crystalline appearance of the Louisiana Agate type.

**3. Montana-type Agate:** This variety of agate occurs in the gravels adjacent to the Ouchita River from the Monroe area south for about 100 miles. It is a distinct, clear, honey-yellow to carnelian red shade and often has inclusions of manganese dendrites or true moss. Such inclusions are identical with the Montana material but the ground color is clear yellow, to red. This is a very solid, fracture free agate of small size occurring in nodules, which in many cases show little signs of weathering or wear; apparently these must be of more or less local origin. They will cut beautiful moss agate cabs and are very lovely as tumbled gems. Another case of strictly float material.

**4. Transparent Chalcedony, Carnelian and Sard:** Ever so often throughout the areas mentioned, pieces of transparent chalcedony and carnelian with more than normal brilliancy will be found. When the sun is low on the horizon, put your face close to the ground and looking towards the sun, keep an eye out for very brilliant pebbles. They shine brightly with the sunlight through them and can be obtained in small quantities. A variety of brownish sard is sometimes found, in fairly large chunks. Its surface bears impressions from contact with some sort of crystal or are pseudomorphs after crystals. The effects of weather and stream tumbling make an exact identification of such crystal ancestry a matter of conjecture. If you luck onto one of these you have a cabinet specimen to brag on.

**5. Agatized Corals:** Water-worn chunks of light colored material with cellular structure and a fair degree of translucency are found quite generally distributed in the areas mentioned in this article. These are agatized colony corals and have been mistaken for petrified woods. Several species of Favosites, are present as well as Halysites, Horn corals and a type identical with Michigan Petoskey stone, but agatized. These date back through the Devonian to the Silurian Age.

These fossil corals often have many cavities containing drusy quartz dispersed in the solid material. Undercutting or holes to be filled, usually discourage the lapidary. Two techniques may be used on this odd material, for gem cutting. One is to finish off the stone and then fill cavities with clear Epoxy Hole Filler and repolish the surface. The other method, is to slab the coral quite thin and lap smooth with #220 grit. Then lap a similar slice of clear quartz, (or glass if you are desperate enough), with #220 and glue the two lapped surfaces together with clear Epoxy of Canada Balsam. Finish off the quartz as the top of the cabochon, thus making a doublet. The honeycomb pattern of Favosites corals cut across the cells and the rectangular patterns developed when cut with the cells will afford stones well worth the trouble involved. Local folks call this material "petrified Honeycomb" and believe it to be of insect origin! The various coral species come in pale cream, yellow golden brown, pink and occasionally red and are float material in gravels.

**6. Agate Crinoids:** An agate material that is suspected of being casts after large Devonian Crinoids, usually has a geode lining, occurs fairly frequently in the gravels. They are similar to examples which have been collected in Indiana. Whether or not our Louisiana and Mississippi specimens were carried here by glacial outwash and melting, is open to question. The similarity of the specimens cannot be defined. The exterior presents a knobby or whorled and

wrinkled appearance and often has little round eye-like markings. Some of this material may be used for lapidary work, some is strictly specimen. On occasion one of these geodes will have a lining of botryoidal material that is a fair grade of Carnelian and some unusual slabs may be obtained. In any event, this "Crinoid Agate" will cause speculation about its origin.

**7. Agatized — Opalized Woods and Palm:** Petrified wood of a quality to interest the lapidary occurs quite abundantly in the eastern part of Texas, northwest and north Central Louisiana, as float only, in southeast Louisiana, and over much of southern Mississippi from U.S. Highway #80 south. Often this material exhibits a white, soft, lime-like exterior, but the interior is solid, colorful and workable. In Texas, the counties of Shelby, Sabine and Newton, which are east of the "Big Thicket" are not as well known to rockhounds as the areas west of it, but nevertheless have some very interesting petrified wood and palm available. One location in Sabine County produces a hard, rough looking wood, the interior of which is marked with contrasting colors of tan, white or light gray, and jet black. It has picture patterns and takes a glossy polish. The one illustrated resembles a thundercloud with lightning. Palmwood in this area is very solid, heavy in weight and ranges in color from white to yellow and buff.

Across the Sabine River, in the Parishes of Sabine and Vernon, Louisiana, Palm and opal woods are found. The palm, though scarce, has a wide range of color. One log was translucent buff with a black center. Two beautiful opalized logs recently were found, the vascular bundles or "straws" were a nice shade of pink and the background color a canary yellow. Palm and wood chips are found in creek bottoms in some profusion near outcroppings of the Catahoula and Jackson Formations. Agatized wood chips, as float are found in clay and sand deposits adjacent to these formations and often are very brilliantly colored. Some have areas of clear chalcedony and a few with carnelian. Nice gravel woods may be found in almost any gravel deposit in southern Arkansas, all of Louisiana and south Mississippi.

A small outcropping with palm wood is found in Natchitoches Parish and northeastward in Grant and LaSalle Parishes. This same outcropping extends eastward and recurs in Jefferson, Claiborne and Copiah Counties in Mississippi. All contain some showing of agatized palmwood. Further east, in Choctaw and northern Washington Counties in Alabama similar showings of this same formation hold a brownish and jasperized palm with open tubes. Some very lovely bookends of this material have been made by Jud. S. Locke, of Gulfport, Mississippi. Occasionally



# AGATE in the SOUTHEASTERN STATES / / /

By Henry B. Graves

*Continued from preceding page . . .*

## AGATES OF THE CENTRAL SOUTH

all of these locations will produce petrified hardwoods that are agatized but most of the material is opal, though in two or three locations there is a black wood which is a combination of Opal, Marcasite and unpetrified wood material. This latter will not polish, being quite soft, but in specimens of this wood of the species *Laurinoxylon baker II*, sawn lengthwise shows a very unusual sheen effect from the perfectly preserved wood grain.

In south Mississippi, Stone & Harrison Counties, there is another area of interest. Fairly large and widespread deposits of petrified wood are found in creekbeds associated with a hard gray clay. When freshly broken, this clay is a bright blue. In one particular creekbed, several tree trunks and stumps are exposed. The petrified wood has all the appearance of being opalized, including the soft limey exterior. The inner material is brown, gray brown, black or mahogany, flakes easily and is much harder than normal opal wood. This material has been positively identified as Live Oak, by Dr. Clair A. Brown, Botany Department, Louisiana State University, Baton Rouge, Louisiana, who is a botanist by profession, a rockhound by inclination and the combination has made a mighty fine Paleo-Botanist.

It might be of interest to point out that although most of east Texas, Louisiana and Mississippi are well covered with pine trees no fossil pines or conifers have been discovered to date. Perhaps it is best not to pinpoint the Live Oak location, as some of the local folks take a dim-view of strangers and they don't want any particular publicity about their home area as it might have an adverse effect on their business activities.

All in all, there are many interesting and varied materials to be found in the Central South. Carload lots are not available, but very satisfying individual collecting can be done in the areas dealt with here. Spring and fall are the best times to get out of doors in this part of the country, so mark these months on your collecting calendar: March, April, May, October, November and December.

If there are agate occurrences in the States of North Carolina and South Carolina I do not know of them.

A pink and gray banded agate of good quality has been found at Wimot's Ravine, Upson County, Georgia but is now somewhat scarce in that locality.

A chalcedony in fairly translucent gray to tan color is found in large quantities near Hawkinsville, Georgia, and it is claimed that this material, while having no pattern, accepts dyes very readily and some beautiful stones can be cut from this material. It is said that the quantity is nearly unlimited.

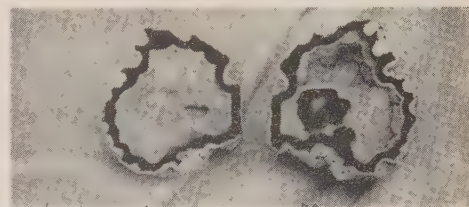
In Florida, the agatized coral from the Ballast Point area of Tampa Bay has been known and sought after for many years. Attention was widely called to this material some twenty years ago when a lengthy, technical and well illustrated article by Manchester was published in one of the Eastern magazines. More recently, one of the Western journals carried an interesting article from the pen of June Culp Zeitner who had done extensive collecting at the above location and worked up much of this material.

Pictures, accompanying Manchester's article, showed the shore well covered with this coral. Today, after thousands of collectors have visited the location, it has become very scarce and it is necessary to wade out far from shore during very low tides, and even then to work under water to obtain any.

Practically all of the Tampa Bay coral is in geode form with comparatively thin (up to 1/2") interior linings of agate in a rough, gray coral exterior. The agate varies in color from almost clear chalcedony through translucent shades of amber, to a bluish black. The inside surfaces are generally botroidal in form and frequently covered with druzy quartz in a variety of colors with an occasional one with almost rainbow iridescence. Some inside surfaces are very smooth and a small percentage of these may be coated with a layer of white opal.

Geodes sawed lengthwise through their center and with the sawed faces polished, make fascinating cabinet specimens. Slender, fingerlike geodes sawed in a crosswise direction produce ringlike sections which, with the sawed faces polished, make attractive and interesting ear-drops or pendants.

Three or four years ago, building excavations in the outskirts of the city of Tampa, uncovered some boulders of another variety of agatized coral which were completely solid and which weighed from a few pounds to several hundred. This resembled the "Petoskey Stones" in general appearance but with



*Illustrations of slabs of colorful agatized coral.*



a somewhat less pronounced color contrast in the coral pattern. It was mostly of an unattractive gray but with occasional areas of more attractive color in shades of amber to brown. As the area was rapidly developed, the source disappeared but future excavation may uncover more.

For many years it has been generally agreed that the Ballast Point area was the only known location for the agatized coral geodes but very recently a few have reportedly been found in the lime rock quarries just north of Ocala, Fla.

I recently had occasion to slab a nodule of some fifteen pounds weight which was also found in the Ocala area and which proved to be a particularly dense, sound piece of agate in an attractive blue-gray color with patterns and bands of snow white and which was susceptible to a mirror polish and which yielded some most attractive cabochons.

As the rockhounds continue their unending searches, Florida may well yield additional attractive material.

## HOW TO CUT AGATIZED CORAL

By June Culp Zeitner

One of the least known but most spectacular cutting materials in the United States is the agatized coral from Tampa Bay, Florida. So ugly and colorless is the agate on the outside that when I sent some to an experienced lapidary he not only refused to cut it, but refused to thank me for it. When I offered some to a dealer for tumbling he said, "coral



is too soft to tumble." But when people look at our collection of rocks and gems from all the states I can always count on our two cases of agatized coral to bring forth the loudest "ohs" and "ahs."

Really pseudomorphs of chalcedony after coral, these specimens are harder, more fracture free, and more varied in color and design than many of the famous western agates.

One reason that the agate is so little used is that it is not particularly adapted to the cutting of the traditional oval cabochon. It is an agate which challenges your imagination. Unusual in color and design, it fairly begs for an unusual shape. Although beautiful cabs can be cut from this agate by a careful and patient craftsman, the agate is most at home in a truly modern setting.

The colors of this material range through the yellow to red side of the color wheel with grayed tones, pastels, and even jet black being common. Although the china blue and black combination is common enough in the agatized coral to make one lose interest in it, the color combination is so rare in other gems that this should be considered "tops" in this agate.

Although the locality where Tampa Bay agate (as it is sometimes called) is found has been known for well over 50 years, each new tide holds promise of fresh supply.

Most of the agates are elongated geodes. Some are lined with quartz crystals. Often the lining is colorful botryoidal chalcedony or drusy quartz over chalcedony, giving the sparkling crystals the appearance of being red, yellow, or black in color.

Highly prized are the perfect agatized sea shells of many varieties and the rarer enhydros, shining pieces of translucent chalcedony enclosing "fossil" water.

Agatized coral is one of the few materials which is perfectly adapted to the tumbling method of polishing. The irregularities of form make tumbled pieces real "three-D" productions, bringing out highlights hand polishing cannot reach.

Unusual jewelry can be made from agatized coral by selecting a finger of coral about 1" to 2" in diameter and slicing it crosswise in thin slices. These interesting free form "hoops" of natural stone can then be ground down until smooth on the outer edge and polished on both sides. Very often you will have a tricolor effect in the hoop. These are especially fine when the inside of the hoop sparkles with miniature crystals.

Another way of making interesting jewelry of the coral is to find an odd shaped piece of pleasing color and instead of polishing it all over, select the spots which would highlight it, give them a fine polish, and leave the rest natural. Again, a piece partly filled with brilliant crystals highlighted on the edges will make an unusual conversation piece.

A third way to adapt the agate to jewelry is to reverse the usual "cut and polish" procedure. As you do not know what the colors or patterns will be until the white limestone exterior is ground off, start by using a coarse wheel and working through the lime until you get to the agate. Here you will note that because of the formation of this agate, the color and size of the pattern can be carefully controlled with skilled eyes for art and skilled hands for lapidary techniques.

As an example in this type of procedure you may first come to a layer of chalcedony, chiefly black and white but a few small eyes of blue. Carefully grind off more of the white until it barely delineates the blue eyes. Check a spot to see if the eyes get larger if you grind deeper. Now perhaps you decide there is too much pattern, that one outstanding pattern would show off better. The patterns change fast, grind off what you do not like. Now that you can see what your agate will look like, mark off the portion you have chosen and cut it out with your trim-saw. Sometimes we even spot-polish parts of the agate before cutting it so that we know we are cutting just what we want.

Because the color and pattern can be controlled by skilled grinding the free form patterns of the eventual jewel suggest themselves. If necessary you can cram the pattern you want in an oval cab, but your result will be more in keeping with your material and more worthy of your efforts if you let the principles of good art shape your stone. A well cut piece of coral should have a pleasing but not "busy" pattern. It will have rhythm, balance, and center of interest.

Perhaps the easiest way to get the design you are looking for in the coral is to select a heavy piece and saw it in two, lengthwise, just off center. If it is a thick-walled piece, or if there are large marblelike spheres or pipes in the

cavity, you will see many gem possibilities. These whole geodes sawed in half and polished on the edges make unique cabinet specimens, while with a little more patience you can polish the entire branched agatized coral on the outside for a real eyestopper.

The most unusual jewelry is made from small agatized shells carefully hand polished, or a clear enhydro, polished enough to make its liquid inclusion plainly visible. Don't try to change the shape of your enhydro and, when polishing, do not allow it to become hot.

The actual method of getting a gleaming finish on your coral can be varied. It polishes so easily that often you will be satisfied with the finish left by your worn 220 sanding cloth. However, a little tin oxide or cerium oxide, fairly dry, on a felt buff will produce a finish that few other stones can equal.

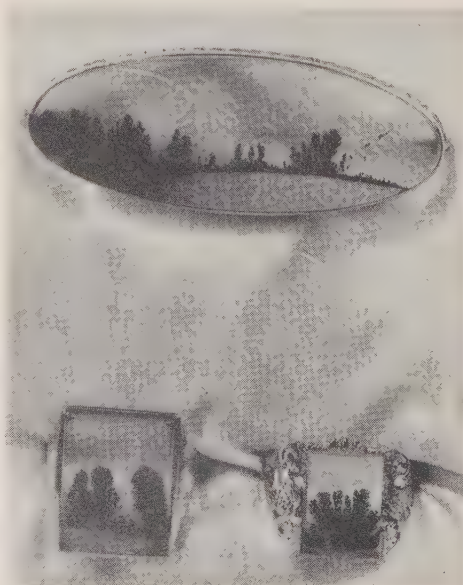
Pendants, pins, bola ties, and bracelets are good uses for the chunkier pieces, and more irregular pieces of coral, as it is very hard to match up such pieces for cuff links or earrings. For any jewelry requiring matched pieces, cutting thin cross sections is best.

Although you will find some agatized coral with fortifications and an occasional piece with a moss-like pattern, most of it is decorated with eyes, swirls, and coral patterns. We found one piece which is iris agate, and one which could be classed as plume.

Like other good agate, the best coral geodes are getting harder to obtain and pieces are rising in price. Still, compared to the unusual results you may obtain, this agate is really a bargain. I feel certain that as more gemcutters get a chance to see what may be done with this material the price will climb rapidly. The best of the agate has been taken from a location which belongs to the city of Tampa and digging in this spot is now prohibited. There is one thing certain—the more you work with this interesting agate the better you will like it.

## MONTANA DENDRITIC AGATE IS BEAUTIFUL

These examples of gemstones produced from the justly famous Montana dendritic agate were made some time ago by Stanley Twedt, owner of Stan's Agate Shop, West Glendive, Montana. The brooch above contains a very fine scene, which is typical of this agate. The two rings show trees and ferns of dense black dendrites. Even more choice are those in which the dendrites are fiery red, some of the scenes resembling a forest fire.





# AGATES OF THE ROCKY MOUNTAIN EASTERN SLOPE

*By June Culp Zeitner  
(with sketches by the author)*

The great Eastern Slope of the Rockies is blessed with VARIETY—a variety of climates, a variety of terrain, and best of all a variety of agates. When you trace the snaking course of the Continental Divide from Canada to Mexico you will realize that most of the gem rich states of Montana, Wyoming, Colorado, and New Mexico lie to the East of the Divide, as well as the entire areas of the “spur” states of the Dakotas and Nebraska.

This is a vast area studded by picturesque names which to a geographer or historian are pure Americana, but to a rockhound are pure paradise: Names like Yellowstone Valley, Sweetwater, Dryhead, Eden Valley, Hell’s Canyon, Fairburn, Crazy Woman Creek, Big Horn, and Agate Springs, just to mention a few.

No one can cover the entire area in a few pages, but there is quite a little repetition of agate types in the area. Here are some which seem the most important to us, together with their classic localities.

## *Montana-Wyoming border*

Since Montana’s splendid moss agates are discussed elsewhere in this issue I’ll start with the rugged and remote border country. Jasper, chalcedony, vein agate, and petrified (agatized) wood dot the Montana side. The best of this “wood” shows translucent chalcedony casts with lacy green moss inclusions. Much of this “wood” is also found in Wyoming. There is often a quartz crystal core in this material enhancing its appeal to specimen collectors.

## *Wyoming*

Although Wyoming, like Montana, has long been known as a fabulous gem area, the surface has been merely scratched. Both states are sparsely populated with large areas remote from any roads except Jeep trails. Both states have long cold winters and hot dry summers, discouraging to casual collectors.

## *Sweetwater agates*

Near the Sweetwater River north of Muddy Gap small dendritic agates with green fluorescence have been found in abundance for many years. These translucent to opaque agates run to small regular shapes, with a good many being sand-blasted and wind-polished. The best for cabochons are the clear to milky white ones with large bold dendrites showing snowflake-like designs.



*The agatized stump by which Mrs. Zeitner is standing weighs 1,200 lbs. She holds a piece of weathered opalized black wood. Both are from South Dakota-Nebraska border area.*

Some of the “Sweetwaters” run to browns and grays. Many of the patterns are too small or indefinite to be prized. One of the best traits of the sweetwater is the ease with which it may be polished. They are ready when found for the final stages of tumbling. Too, there are few fractures.

## *Wiggins Fork wood*

High in the beautiful but forbidding mountain country near Dubois, Wyo. is a remarkable fossil forest. Here volcanic ash from tertiary times buried vast forests which are now being eroded out to the delight of venturesome rockhounds. Imagine, if you can, a country so rough that even Jeep and horseback can barely get you to the right spot; a country where snowstorms in July are not uncommon: where steep canyons and towering cliffs reveal agate wood casts, fossil cone casts, iris agate limb casts and agatized wood with amethyst. If you can picture this you can picture

Wiggins Fork. My husband, Albert, spent one Fourth of July snowbound in this area but the bag of rock he returned with was ample compensation. Ralph Platt of Saratoga has exquisite examples of this material which he has given skilled lapidary care. The fine iris agate, the banded chalcedony wood casts, the green moss—all are virtually flawless. The agatized seeds, catkins, and cones of this region are unsurpassed.

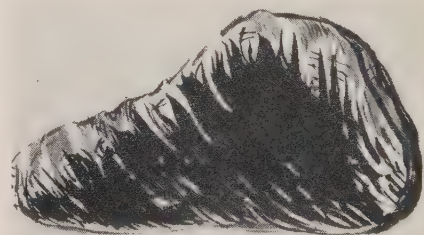
## *Eden Valley Wood*

Petrified wood is barely mentioned before some rockhound will start talking about Eden Valley wood. Long a favorite of gem cutters, this highly agatized jet-black wood often has interesting patterns of clear chalcedony and taupe. There are many kinds of wood, the most popular being the limb sections of such trees as willow or pine. The most fascinating are bamboo and agatized burls.

Although named for the town of Eden the wood is found over a large area to the east and merging with the jade fields of Lander. It is strewn over the ground but better quality may be had by digging. The outside of the wood is a buff-colored, dead-looking coating which looks much like weathered driftwood.

## *Crazy Woman Creek Wood*

Another top ranking stone forest of Wyoming is near Buffalo on Crazy Woman Creek. Over 100 varieties of semi-tropical plants have been identified from this field. Wood grain has been preserved by silica in fine detail. The silicified logs, often with amethyst cavities, are of giant size, many upright stumps standing 20 feet tall.



*1. Agatized black wood—Nebraska. 1/4 natural size.*

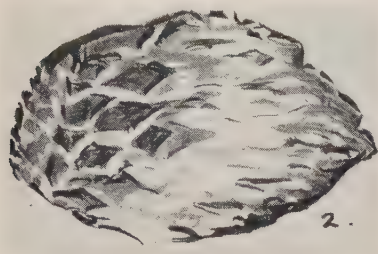
## *Guernsey Lake Agates*

Every summer we watch hundreds of National Guard vehicles pass our place on their way to the encampment at Guernsey, Wyo. A few weeks later I can count on seeing piles of “loot” as



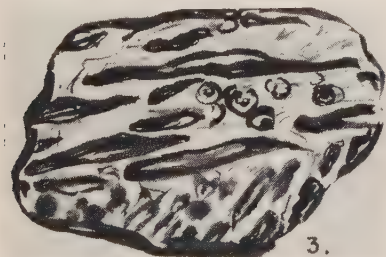
the rockhounds of the National Guard stop on their homeward journey.

The variety of agate, chalcedony, and



2. *Cycad slab, South Dakota.*  $\frac{1}{8}$  natural size.

jasper from this area is amazing. Some of the agates are so similar to South Dakota's "Fairburns" that only old-time fairburn collectors can spot the minute differences. The wood, which is float, also resembles Dakota badlands material. But here the similarities end. There is quality moss agate in veins, which as a bonus is highly fluorescent. There is "stalactite agate," crystal clear, with eyes and tubes of white and silvery gray, frosted with brilliant drusy quartz. There is "youngite," a lovely clear chalcedony with geometric and free-form patterns of pink, peach, apricot, and coral. There is a brightly colored jasp-agate with intricate fortifications, recently discovered by the well known Bass family. In fact agate of the Guern-



3. *Teredo wood, North Dakota.*  $\frac{1}{4}$  natural size.

sey area is so interesting I can hardly wait for the next National Guard group.

#### *Dryhead Agate*

A fairly new discovery in agate is the Dryhead agate of the Big Horn basin. A colorful jasp-agate with intricate fortifications, this stone fluoresces green. The Breitweisers of Powell, pioneers in the exploration for this agate, have a collection of all sizes and colors. However the average collector will find more reds and browns than other colors. Like many other agates, the smaller ones are usually more beautiful.

#### *Turritella*

Near Rawlins is found one of the most unusual agates of all. Called turritella for the little shells of which it is composed, it is doubly interesting because of its locality. A great ridge of perfectly preserved fossil sea shells, high and dry among 10,000 ft. peaks cannot fail to stir the imagination. Equally, the



*An agate nodule from Wyoming in the author's hands. The large rock in front of her feet is cycad. All the materials in the pile are from the Eastern slope area.*



8. *Turritella agate, Wyoming.* Appr. natural size.

gem cutter is inspired by the compact material with its bold patterns. Colors in turritella agate vary from beige and gray, to brown and black, with the top grade having entire shells replaced by clear-to-blue chalcedony.

The average shell is about one inch, conical in shape, with each compartment well defined. There is a current vogue of tumbling the individual agatized shell which has weathered out of the less resistant matrix of some area.

#### *Colorado*

Our own best finds in the agate family of Colorado have been in the fossil category, agatized wood, plants, or dinosaur bone. Nevertheless Colorado's Eastern Slope is famous for a variety of jaspers, chalcedonies, jasp-agates, plume agates, and even Fairburn-type fortification agates.

#### *Agatized Wood*

Agatized wood is found near Denver, Greeley, Colorado Springs, Canon City and in the Platte River Valley. The colors are brown to gold and gray to

black. Much of this wood is semi-tropical, but many identified pieces of well preserved agatized wood boast living relatives in today's forests of the region. Some of the finest wood for lapidary purposes comes from South Park, a high and lovely plateau.



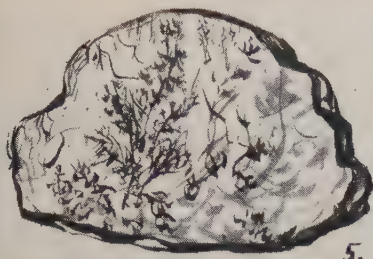
4. *Eden Valley wood, Wyoming.*  $\frac{1}{2}$  natural size.

#### *Dinosaur Bone*

While there are many localities for superb dinosaur bone in far-western Colorado, the principal one east of the divide is near Canon City. This bone, variously described as agatized and jasperized, but more properly "silicified," comes in gay paisley colors. The deep red or carnelian type is best especially when the lacelike cellular structure is intricately preserved. However the clear yellow is also a collector's item.

The biggest trouble with the field run of "bone" is its tendency to undercut in polishing, due to porous matrix or uneven silicification. The good quality bone will remain one of the most interesting of Colorado's gems.





5. Green moss agate, Wyoming.  $\frac{1}{8}$  natural size.

#### Moss Agate

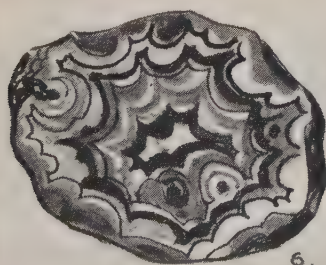
Plume agate comes from near Del Norte in thunder eggs, nodules, and thick veins. The colorful plumes in translucent chalcedony compare with the best of plume agate from any other locality. A rich yellow-gold plume predominates, black is fairly common, while the rarest is scarlet. Moss agate is found near Antero Lake, and fluorescent moss opal along the Republican River.

#### Banded agate

Vari-colored banded agates are found near Canon City. The agate which is found in veins, and nodules, is of high quality. Banding, both wide and narrow is in reds, yellows, and grays. The banded agate of Hartsel is gray-blue and white. The brightest of Colorado banded agate is the pink-red-brown fortification agate of the Fairburn type which is found in the tri-state border area north of New Raymer. These agates are now scarce, and fracturing is a common fault.

#### Other Colorado agate

Carnelian of the finest color is found near Colorado Springs. A Polka dot agate is found near Canon City. A pink and blue "flower" agate comes from central Colorado. Bloodstone is found near Fairplay.



6. Fairburn agate, South Dakota.  $\frac{1}{4}$  natural size.

#### South Dakota

The Black Hills of Western South Dakota is the oldest mountain range in the U.S., however present day geographers regard this area as a spur of the Rockies. This whole region is rich in agatized forests, and great ridges of agate in-situ, as well as vast alluvial deposits of gem material.

#### Fairburn agates

Originally found near the town of Fairburn, these fortification agates can now be found over a large part of south-

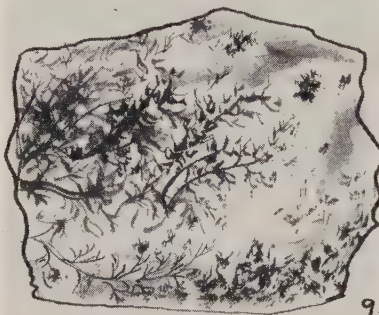
western South Dakota. The old time Fairburns were brilliantly colored, exquisitely patterned nodules of solid high quality agate. However, at the present time they are so scarce that many jasp-agates and agates with a large amount



7. Youngite, Wyoming.  $\frac{1}{8}$  natural size.

of matrix are passing as Fairburns. Good true agates can still be found, but not without work and patience. The price of Fairburns, perhaps most inflated of all agates, is based on beauty, scarcity, and the fact that numerous collectors have created a ready market for good finds.

One of the interesting things about Fairburns is that those of a particular



9. Dendritic agate, Wyoming.  $\frac{1}{4}$  natural size.

field tend to have similarities of pattern and coloration which make them easily identifiable to the experienced collector. For example those of Red Shirt Table tend to have brilliant red bands with much black on the exterior. A pound is considered a large size for a Fairburn,

with good cabinet specimens running a quarter of a pound.

#### Teepee Canyon agate

Near Custer is a limestone walled canyon, literally studded with jasper and agate nodules. Resembling Fairburns, the bright bands in these agates are finer as a rule. Some Teepee, agate has an amethyst center. Some has a lemon yellow color with the characteristic reds. One limited area has blue and violet bands. The nodules vary in size from egg-size to larger than a basketball. They are suitable for specimens, cabs, and tumbling.



10. Agatized coral head, South Dakota.  $\frac{1}{4}$  natural size.

#### Cycad

There is much fine quality agatized wood in South Dakota. There are also rare agatized ferns as *pteridosperm* and *tempksya*, but the most sought for of our exotic species is *cycad*. This ancestral flowering plant can be found in the Hot Springs area. Often highly agatized the pleasing warm colors and distinct diamond-shaped patterns of this large pineapple-shaped fossil make it a choice item for the gem cutter.

It is my prediction that in the next few years dozens of new locations as well as new agate types will be found in the great Eastern Slope area. So large and varied is this area that, so far, the more rockhounds who visit the area, the more rocks seem available.

## IS THIS MICHAELANGELO'S "CREATOR" OR JOHN L.?

The picture shown at left was cut from a large piece of plume agate quite by accident by Wm. E. Clark of Clark's Gem Shop, La Porte, Indiana and is completely unaltered. It looks very much like the heroic size figures carved by Michaelangelo for the canopy over the doorway in the Cistine Chapel in Rome, or it could possibly resemble craggy-browed John L. Lewis, long head of the Miners. The million to one chance that all parts of a natural picture will grow exactly in place in such a picture makes it all the more interesting.





# THE AGATES OF UTAH

*By Glenn C. Osborne*

I first became interested in southern Utah's agates when I read an article by Albert Hubert, a rock dealer of Hurricane, Utah, now retiring. He described the Central agate location. Central is a small farming community north of St. George. I found one or two pieces the first time I was there, but it wasn't until the second time that I really found where it was.

To get to Central, you can go in by either St. George or Enterprise. St. George is on U.S. Hiway 91 and about as far south in Utah as you can be and not be in Arizona. Go back south out of St. George, and take the first road to the right. You are heading for Veyo and Central, and there should be a sign somewhere there. The road is paved and pretty good. Be sure you take along a camera loaded with color film because the road leads right by Snow Valley. You can drive out to the rim in a couple of places. This huge brilliant red canyon is about as spectacular as anything you are liable to see. I've tried to get good pictures of it twice, but clouds and muggy weather foiled me both times. This doesn't happen very often—only when I'm there.

Just at the head of Snow Valley is a hill that is as white as the valley is red. Near here you will see an old lava flow to the left of the road. If you are interested, look this over. I have a piece that had so much included gases that it looks almost like lace.

The first town is Veyo. The old Spanish trail goes through here, and I imagine that is where the town got its Spanish sounding name. If you turn to the right, just before crossing the bridge that leads into town, you can go down to the bottom of the gorge made by a creek cut. There is a camp ground, a swimming pool, and the old road that crossed there. On the west side the old road is cut from solid rock. Iron stains cut from wagon tires are still visible on the rocks. I believe this is a piece of the Old Spanish Trail.

Central is further north and off to the east of the main road a short piece. To get to where I found agate, just continue through the little community till you come to the Dixie National Forest Boundary sign. Just before that sign you will see a road to the left that goes through a gate into a field. Take this, being sure to close all gates behind you; I don't want to find a KEEP OUT or NO TRESPASSING sign the next time I venture that way. The road forks up in a dryland wheat field that is in the mouth of a side canyon. Take the left fork on up and out of the field going

northish. Remember that gate! You will be going up a canyon. About a half mile above the fence start looking on the hill to the left of the road. Some float has washed down in the gulches, but most of the agate comes from high up near the cliffs. There are some geodes here too. They have, oddly enough, an outside of calcite and centers of agate and quartz crystals.

Continue up the road, and take the left hand road first. Shortly you will come to a camping spot, which is the end of that road. This isn't a forest camp, but just an open space where people have camped. There is quite a bit of agate on the hill south and west of the camp ground. This is another side of the same hill you were on earlier. Here the stuff seems to come up in veins that run up and down the hill. Find a piece of float, then prospect right up the hill.

I found some nice pieces of float agate in the wash of the main canyon that runs northwesterly. I followed this but dead ended. Yes, the agate was there, but some one else found it first. It is under mining claim, and the assessment work has been done. Anyhow it was last year. I got off quick. There just might be agate further up. I never got up there.

Now try the other fork in the road. There is a steep hill out of the canyon. Then you drop down into the head of another canyon. You will find another camp ground. Just above it there will be a ditch. There was water in it when I was there. Follow this ditch till you find where people have dug into the bank. You may be able to find some good stuff here. Albert Hubert said he got his agate south of town, so there should be more stuff in that direction. I've never been down there.

If you want a camp ground that is closer to Veyo, there is a forest camp above Pine Valley (a little town). Also there is a lake and fishing. Pine Valley is up the road you turned off, above Central.

If you come in from the north, go to Enterprise. This is a town west of Cedar City and south of the main road to Panaca, Nevada. By the way you will have to pass right by Iron Mountain on the way. The Columbia Iron Mine is just off the main highway. The iron is high grade magnetite, about 70% iron. I have seen a bail welded to a piece of it! There are some colorful pyrites too. The Columbia people don't seem to mind visitors, but you should ask. Stay out of the way of the giant trucks! You can see the whole opera-

tion from the drilling for explosives, the giant electric shovel, the Euclid trucks, the conveyors, the crushers, and finally the loading of railroad cars.

Just east of Enterprise is the road that goes by Central. Climb over the pass south and there will be a dirt road coming from the left. Somewhere around there is the site of the Mountain Meadow Massacre. I don't know just where it is. By the way this dirt road more or less follows the Old Spanish Trail on out through Pinto, a small town. Of course, follow the main highway to Central, and continue as described before.

I'll never forget the second trip I made down there. We made plans to go with another couple. As we both have pickup trucks, we decided to sleep in them. We would go down one evening, prospect the next day, and return home. I got my pickup ready, or thought I did, the day before. When we left it was blowing a hurricane. At a small town, I noticed my gas gauge was right on E. At first I thought my gas gauge was bad. So, to be sure, I looked at the spare gas I had in the back. It had sprung a leak and ran under the bedding. The gauge was OK too; I'd forgotten to fill the tank before leaving. A few miles down the road, the radiator began boiling like a teakettle. I had changed my summer thermostat, and never tightened the top radiator hose thoroughly. All the water had leaked out. Luckily, we had plenty of water. There were no further incidents until we reached the campground at Veyo. There we found a National Guard Encampment. We found a place to camp and settled down. The five gallons of gasoline had pretty well soaked the bedding. We hung some of it out for the night and slept in the drier portions. Just across the creek was the swimming pool and an extra loud juke box. The Guard boys kept this going until midnight. Then we got some sleep, or rather gasoline-induced coma. At 3:30 it sprinkled some, and the other people got up. They were afraid it would really get to raining. So we were all breakfasted and ready to go by 5 (very much) a.m. After some futile looking, we struck the first of the agate I described. By 11 a.m. it got to raining and we had to quit. It was a good thing we did get up early for we did get some nice agate.

I found another large agate deposit quite by accident. We had planned a purely sight seeing trip to the mountains east of Parowan. This country has some fantastic red formations that rival even the famed Cedar Breaks National



Monument and Bryce Canyon. We went up the second left fork of Parowan Canyon. This is the second fork to the left, and this road goes across the mountain to Panguitch Lake. The first left fork goes up past the Vermillion Castle (a fantastic pile of red rocks) to a forest camp. Be sure you have a camera filled with color film in this area too. If you can get some of these unbelievably red formations surrounded by green trees, and a few pure white clouds peeping down from a cerulean sky, you've really got a picture. We photographed our way up this second left fork until we got in a thick forest of quaking aspen. The road switchbacks up the mountain and at last you come to an open ridge. A natural impulse is to stop and see the panorama below. This I did. As I stepped from the car, I noticed a piece of agate the road grader had plowed. It wasn't very good agate, but I forgot all about scenery. That ridge is covered with agate and you can't miss the place. It will be the first open ridge after starting the switchbacks. Also there are some ponderosa pines on the ridge.

We now turned off to see what Yankee Reservoir looked like. I ran into more agate on the road. The road grader had plowed it out. After satisfying ourselves that Yankee Reservoir was strictly for fishermen, we returned to the main road. It climbs over a spectacular road to the top of the mountain. These mountains are peculiar in that they are a vast plateau. After you are once on top, there are rolling hills and you will be up over 10,000 feet. The timber and scenery are magnificent; well worth the trip if you never see a piece of agate. Up on top, in a road cut, we found some more agate. If you prospect around a bit I'm sure you will find more locations.

We were so successful on that trip that we decided on a trip later in the season. It had been a summer of hard hitting thunder storms. As we went up Parowan Canyon we saw signs of a flood. There was a "Road Closed" sign half way across the entrance to the second left fork. As it was only half way across, we figured maybe the road was only half closed. (Some reasoning!) The road was rough but passable . . . until we got to a place where half the mountain had washed down across the road. Someone had crossed in a four wheel drive, but I couldn't see myself trying it in my new pickup. I would have ended upside down in the creek below. We sadly retreated to go up the right fork.

This road leads to the justly famous Cedar Breaks National Monument. When we were about a mile from the Monument, we noticed some agate lying alongside the road. Without bothering to park the car, we got out

to investigate. The more we looked the more we saw. A car came along and I had to park off the road. About a quarter mile off the road we found dikes of agate. Further up we found dikes that were close to the road. You'll need something to wedge out pieces here although there is lots of loose stuff. Further along the ground was almost paved with it. If you wanted to throw a rock, it would have to be a piece of agate. Of course all this agate isn't first class, but there is some pretty material. If you can tear yourself away you should see Cedar Breaks. By now you are only an agate throw from the west gate.

If you wish, you can come up that way. In fact, that is a better road. Start from Cedar City, and follow the signs to Cedar Breaks. This road has impressive scenery too. Look at all the different views down into Cedar Breaks, and eventually wind up at the west gate. Be sure not to go toward Panguitch Lake, but toward Parowan. A short way beyond the gate you will see agate. While you are here, you might as well drive up on Brian Head, which is the mountain just north of here. It doesn't look very impressive until you get up there and look at the altitude sign—11,315 feet. You can see Zion Canyon far to the south on a clear day.

All of this agate I have seen is remarkably alike. The most colorful of it is red and yellow moss agate. Some of it will grade toward jasper. A lot of it is whitish and rather opaque. A little is dendritic, but most of this is too opaque. I have a piece that happened to fracture right on the plane of dendrites. I wouldn't be advertising these locations if it had been clear, like Montana agate. Some of this agate is clear, but without dendrites.

Now it just isn't in the cards that I could have located all the agate in this vicinity. There is sure to be much more. The big advantage of these mountain locations is that it is so nice in the summer. Most locations are in the desert, and are strictly spring and fall stuff. Here you have nice camp grounds, or you can stay in good motels in Cedar City or Parowan. There is good fishing in streams and lakes and scenery the like of which you have never seen. At this altitude, hot weather is just a vague rumor. There are nice rocks to be found. What more could a rockhound want?

(Editor's Note: The visitor to the area should be provided with a good map supplied by any of the gasoline companies. No other map is needed if the reader will follow the author's good directions. The author mentions Mr. A. L. Hubert, who wrote an excellent article about the area entitled *Where To Go In Utah*. We have excerpted those portions which deal with agate.

## Where To Go (Elsewhere) In Utah

By Albert L. Hubert

Let's start at the southwest corner of Utah and I will show you many places or tell you about them.

Turn northwest from Castle Cliff station, just four miles north of the Arizona line and take the gravel road to the upper Beaver Dam wash. Some fine water-washed boulders of "wonder stone" are found along the wash. They make fine bookends and spheres. There are some small pieces of wood there and some fine jasper. You can find some nice white gypsum crystals in the wash.

North of St. George, at Central, there is a very large deposit of basalt and you can find the best grade of blue banded agate there that you will get any place. It is as good as any Brazilian agate you can buy. It takes color well and there are nodules of all sizes up to 60 lbs., the biggest agate I have ever seen from there. I had one that weighed 50 lbs. and it cut slabs that measured 65 inches to the slab and very well banded. One nodule cut fine butterfly wings and I have the best pair of the wings that I got out of it. They measure over 40 inches each and have a fine lacy pattern.

This basalt is the hardest stuff I ever tried to work, and you just find agates in the cavities. I know of two men who found 500 lbs. of them in one cavity and then worked two days before they found any more. I found some nice ones in a wash that runs south from there and I have been told that there are some to the north around the big peaks.

In the lava rock on the hills you may find some pieces and some small nodules, but most of it is broken but it is good for cabochons. Most of it is banded and you will find some clear agate, good for coloring.

North from St. George you go west of Cedar City to New Castle where there are some fine star agates of all sizes up to two feet in diameter and all geodes. They fluoresce bright green because of an opal coating inside. They are not cutting material.

I used to get some extra fine agate in Blue Valley, just south of Beaver but it has all been picked up by the rockhounds. I have about 500 lbs. of it and it is black agate with blue bands. Some of it has cross bands, fine for cameo agates. This stuff has great contrast and you will like it. You may find some in the washes below the deposit.

In Salina Canyon two miles east there are some fine agates in a narrow side canyon. To the south is some greenish onyx but it is hard to get high up on the ledges.

Enter Emery County and to the east



of the highway there is the big reef. There you find some nice agatized dinny bone (dinosaur bone), wood and agates.

This is a big country for strangers to venture into alone. Stay out if it rains for it is like traveling on grease on those wet roads. That reef runs for fifty miles north and there are a few places where good stuff can be found.

At one old dinny quarry I found some nice specimen bone and got a fine well-preserved dinny tooth. On the way out I found a nice vein of blue agate in all sizes and some good jasper-agates.

On the cut-off road, between Castle Dale and Green River, there are a few places where you can get some dinny bone, wood and some agate. It is not plentiful but it is all good cutting material. The Vernal rockhounds all come down into Emery or Grand Counties to get the good bone they sell in their shops. Northeast of Vernal there is some fine river agatized wood for good cutting found in the gravel deposits. Some of it is opalized and it is all small pieces.

West of there, at Heber City, they find some very well colored opalized fluorescent wood, but most of it is badly fractured. One can get some cabs out of the better pieces and it is fine for your lamp set or fluorescent collection. There are some agates there and they have a bird's eye granite there that cuts up for bookends and spheres.

North of Moab there used to be some good bone, wood and agates, but they have nearly all been gathered by the Colorado and Vernal rockhounds.

There is some material around Green River. In fact the gravel beds wherever you go yield some wood, bone and agates of all kinds. They are all river washed and are solid. I found a nice piece of black bone in a gravel pit at Woodside that had been tossed on the boulder pile. Turn south at Green River, toward Hanksville, and stop there at the bridge across the San Rafael River and turn west on the old road for two miles and you can find a little grape and carnelian agate. Three years ago a friend and myself went in there and got some of both kinds but a few weeks later some men reportedly came in there with nine big dump trucks and hauled it out and now you cannot find much there. When we were there the ground was covered with material.

On the rolling hill on the road to Hanksville you can sometimes find some pigeon blood agates and the barite agates, usually very fine. Many miles of that road are paved or graveled with red agate in small pieces that have weathered out. You may find a few pieces of wood along the road. Northeast and east of Hanksville there is some good bone and west of the Henry Mountains there is some very fine bone, wood, and agate. As far east as the Colorado River there are places where one can find good gem rocks.

West of Hanksville there is a bed of small clam shells that is hundreds of feet thick and it runs for miles. In the top part of the hills along the road there is a vein of water washed pebbles that look like dinosaur gizzard stones, the way they have been water polished. They are all agate and of all colors. They are the finest lot of cutting material I have ever seen. You will want to take all you can find, and I don't blame you. None of them are over three inches through and long. They are very fine and one can get a lot of them in many places although they may have to be packed a few hundred yards. The little clam shells are so interesting that you can't pull yourself away from them. They are lime and not agatized, as are some shells.

A few miles west of there we come to a low cut between two hills. On those hills we will find wood, agates and some fine gem conglomerate. Some pieces weigh hundreds of pounds. Some of the wood is well colored. It is a hard place to leave and you will like to linger.

The Circle Cliffs are south of Wayne Wonderland and people are getting some fine wood and agates there, since they have made some roads. They are mining uranium there now and one can get in there. Stay out in the flood season for you may not get out. The wood is not too outstanding but they are getting some good material in some

places. You will need a jeep or four wheel drive at this spot.

Near Torrey we can get some red and black agatized wood that is fine for bookends, and there are a lot of big pieces there. There is lots more of it in some places but the best is back from the road and has to be packed in.

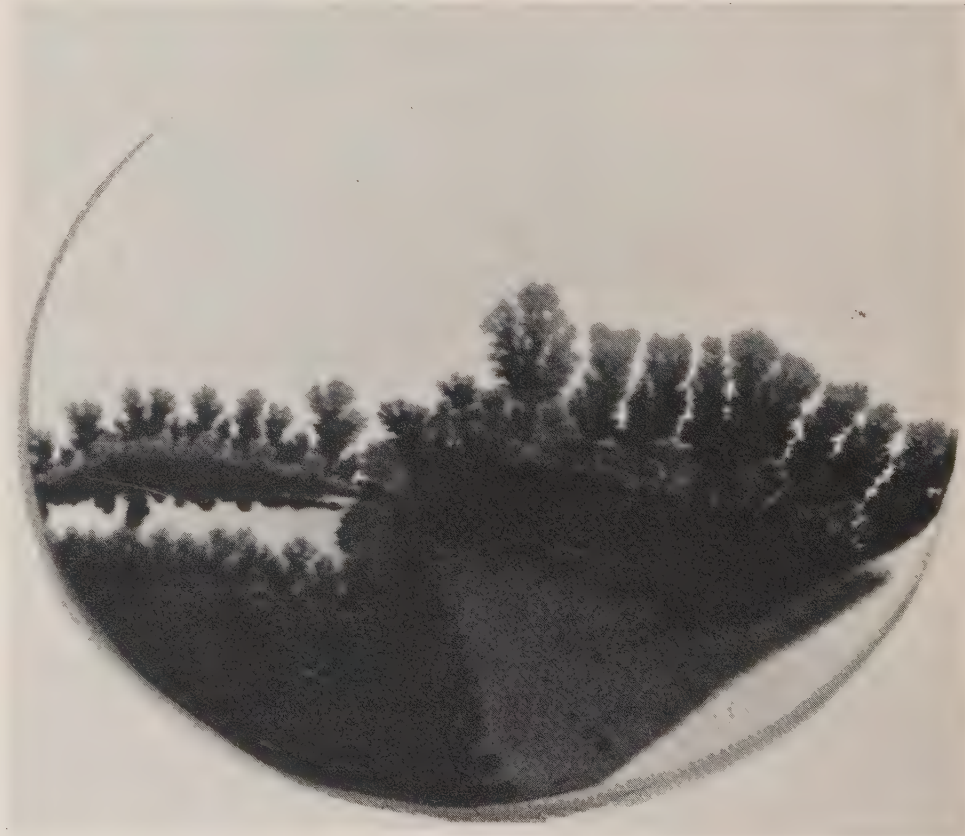
We turn south of Torrey to go over the Boulder Mountains but there is little gem material there; at least I could never find any. It is now best to go to Bicknell and then go south to Escalante and work the hills along the road for some good bone, wood and agate.

We go on to Hatch, for that is on the road home and we have some places to look at there.

West of there I found a vein of green, red, blue and yellow agate and if you take time to work back into the vein you will get some very fine gem material. It is a long vein.

Let us take some time to look over the gravel beds along the Green River for we will find some fine petrified wood, agate, and dinosaur bone in them and in the valley. Wherever you find gravel beds spend some time looking them over.

All along our trip we are near deposits of fine agates, wood and "dinny" bone and one could spend weeks collecting. Each place makes a good excuse to spend days, for you never know what you will find, or when or where you will find the most unexpected things.



#### UNCANNY PERFECTION

*The perfection with which nature can paint scenes in dendritic agate has always amazed rockhounds. In this scene, even the reflections in the lake on the left mirror the line of "trees" while a bluff and a plowed field are simulated on the right. The agate is from the private collection of Joseph L. Jost, Hilger, Montana, and measures 1½" x 1".*



# A BEAUTIFUL WYOMING AGATE

By Wayne R. Breitweiser

A beautiful fortification agate, as colorful as the finest Fairburn, has been the object of an intense search by my wife, Betty, and I for the last seven years. The agate, just as elusive as it is beautiful, is to be found in place along the rims of the Big Horn River Canyon on the northern edge of Wyoming and the southern edge of Montana, an 80-mile long area of beauty, inaccessible except by jeep, horseback or on foot.

This rugged terrain is known as the Dryhead—the same name given the fortified gem by the few rockhounds in the country who have been lucky enough to find it. Not only does the Big Horn Canyon traverse this country, perhaps fifty other canyons just as deep and just as spectacular as the Big Horn drain this area, and they all empty into the river.

There is one trail that travels the length of the Dryhead and it's suited only for jeeps and sturdy pickups. At only one place does this trail go within a mile of the big canyon; usually it is miles from the Big Horn. The trail climbs sides of mountains with switchbacks so sharp vehicles must almost bend to make the turns; a vehicle will high-center in dozens of places. Anyone unlucky enough to get caught in a rainstorm while in the area will stay there until the trail dries, because the flats will be deep with mud and the hills so slippery vehicles cannot get traction. Any thunderstorm high in the Pryors will cause flash floods down in the Dryhead.

Dryhead agate that we have found is located miles and miles from this trail and we find it impractical to leave the trail by vehicle at any point in order to get to the agate for always we have been rimrocked by some deep and beautiful canyon. Our exploring off the trail is always done on foot.

Years ago a rockhound friend of ours told us about a cliff of pretty rocks along the Big Horn about ten miles north of Kane, Wyo. We went there and found fortification agate with quite thin, delicate lines and curves in pastel colors. Most of this material was broken badly by someone long before the white man set his foot upon the scene. Thousands of Indian chippings are found in the area. Being arrowhead hunters, besides rock fiends, we searched for points but found none. In fact, we've never seen Indian tools of any kind made from this material. However, because of the chippings, there must be artifacts of this material some place.

Some years later rancher friends in the Pryor Mountains showed us a beautiful fortified agate which they said came

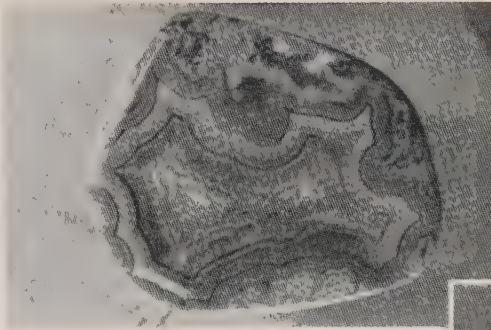


Fig. 1

from the Dryhead country. To us, this agate looked every bit as pretty as any Fairburn we had seen so we started on another search for the Dryhead.

Last summer, after extensive searches and plenty of foot blisters,

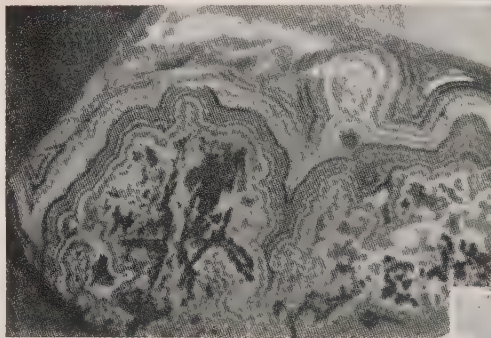


Fig. 3

we finally found the Dryhead fortification agate. But we also found that on one ridge there might be a small outcropping. Then we might cover ten or twenty more ridges without finding a single trace of the elusive gem. We did, however, discover what we think is a complete oddity in fortification agate—Baby Dryheads—fortified gems as small as a half-inch in diameter and running up to an inch and a half. Each has at least one fortification, sometimes as many as five in one stone, no matter how small. We find that these make beautiful tumbled agates.

If the Baby Dryhead is an oddity, then with the Dryhead agate we have discovered a rarity. Even in the smallest agate the fortified lines will fluoresce under the short wave mineralight; or just one fortified line will fluoresce. To make this rarity more of a mystery, in both small or large agates, one fortified area will fluoresce while another in the same stone will not.

In bigger stones that we have found the same pattern of fluorescence takes place. In picture top left, Fig. 1, the outer black line, the inner crystal area, and the fortification inside the crystal

They call it  
“Dryhead Agate”

area all fluoresce while no other lines in the rock show color. In the next two photos Fig. 2 and 4, just four areas fluoresce—the two ends and

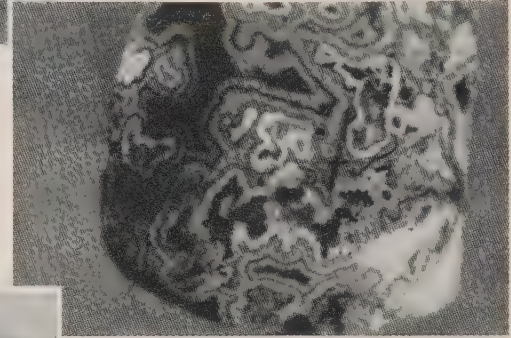


Fig. 2

two small areas on the outer sides. The picture Fig. 3 shows the largest and most beautiful Dryhead agate we have polished so far, and all fortified areas in this specimen will fluoresce. Dryhead agates come in all sizes besides the babies. Our largest is a four

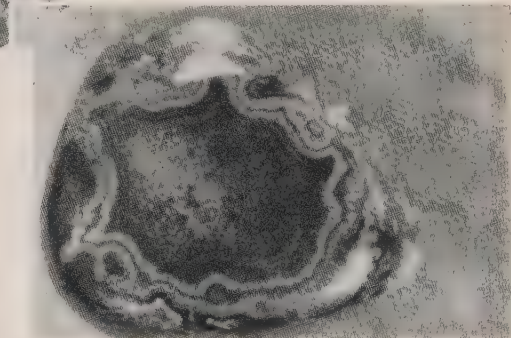


Fig. 4

pounder which we haven't cut as yet but there are fortifications in it because they show on the outside with the mineralight.

The agates, as we find them, have either limestone or red jasper matrix. We have found some Dryheads resembling Teepee Canyon agate of South Dakota but they differ from Teepee in that the fortification inside will fluoresce. Lines, curves, swirls and circles in the agate run from red to pink to yellow in color. We have found only one agate with black fortified lines.

The Dryhead agate works into superb specimens and will dress up any collection. There is excellent cabochon material in every stone and we find it well worth walking miles and miles to find.



# THE FAIRBURN AGATES

*By Jack Zasadil*

Not until after the turn of the twentieth century was there very much known of the Black Hills and Bad Lands. This was Indian country and the caravans moving westward always bypassed the Black Hills and Bad Lands because the red men resented the invasion of these prized possessions.

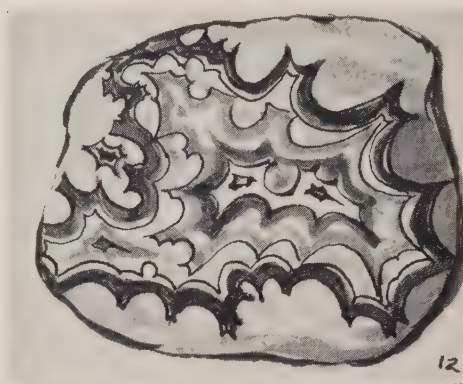
In the heart of the vast expanse of the Northern Plains, where for generations the trails in the buffalo grass marked only the passing of the mocasined Sioux, the trailing *travois*, and of migrating buffalo, the granite spires of the Paha Sapa form majestic silhouettes against the azure blue of the Dakota sky. For generations this mighty domain, bounded on the east by the Big Muddy River and on the west by the snow-capped summits of the Rockies, was the home and hunting ground of the nomadic tribes which constituted the great Sioux Nation, and the Paha Sapa, as the Black Hills were known in the language of the Lakotas. This mountain land of pristine coolness, was a land revered and honored. For in the higher reaches dwelt the Great Spirit, the red man's God, whose protecting mantle rests upon the tepees of the prairie tribes. Thus the snows of many winters had come and gone in the land of the short grass.

1874—There was something prophetic, something foreboding, in the very silence of the lonely prairie. Early summer, and long lines of pale face warriors, the Seventh U. S. Cavalry, commanded by General George A. Custer, moved slowly in from the northeast, into Paha Sapa. The days of Sioux domination in the Black Hills were numbered.

It was during that summer of 1874 that the auriferous streams of the pine-clad Hills gave up their secret—GOLD. Gold was in the crystal waters. The spell of magic was carried on the wings of the wind. The treaty of 1868 creating the Sioux domain was forgotten.

By the year of 1876 the rolling tepees of the pale face were entering the Black Hills in ever increasing numbers. The canyon walls echoed the crescendo of human activities. The gold pan of the placer miner yielded more and more of the precious metal.

But the gold pan of the miner not only yielded gold but signs of tin, iron, beryl, garnets, tourmaline, petrified wood and agates. It is only natural for the prospector to pick up these foreign particles and have them identified. So it was that a prospector, always seeking,



*A typical Fairburn agate pattern.*

had wandered down French Creek and found the Fairburn Agate beds.

The Fairburn agate is a beautiful fortification agate in bright colors. The

natives call them "ribbon agates" and they are sought by all collectors, bringing a fancy price for fine specimens. They are scattered over an area about twenty miles wide and a hundred miles long. The most noted and hunted area is about fifteen miles east of the town of Fairburn, which gives its name to this agate.

I have found them from Scenic, to the northeast of Hermosa, to Orella, Neb., just across the South Dakota line, I have heard of them being found as far south as Gordon, Neb., and from my place at Hermosa eastward to Cooney Table, thirty miles away. Some very nice agates came from there. In these beds you will also find jaspers, and many more specimens are quite well represented.

You'll find me at "Whittling" Jack Zasadil's Agate Shop in Hermosa, S. D.

## How To Cut Fairburn Agates

*By June Culp Zeitner*

Author of *Midwest Gem Trails*

Mission, South Dakota

Many sub varieties of agates present unique cutting problems. Only unfortunate trial and error or patient study or instruction reveal the technique best suited to bring out the full potential of these specimens. Although South Dakota's famed Fairburn agates are similar to other fortification agates, they are in a class by themselves when it comes to cutting them.

Most Fairburns of average size (say 3 inches in diameter) or over, should be used as show pieces in your cabinet rather than for jewelry or other lapidary uses. The reason for this is that the real beauty of a Fairburn is in the intricacy and color of the entire pattern. Small parts of this pattern, when removed from the whole, lose much of their beauty. A Fairburn showing a colorful complete pattern is a valuable collector's item. Not so with small pieces.

The first thing to consider in trying to decide how best to increase a Fairburn's beauty and value is to study the pattern. If you are lucky enough to possess a Fairburn agate with a full face pattern covering one side of your agate,

your work is blueprinted by nature. Merely grind the surface contours of your prize with a medium silicon carbide wheel, preserving as much of the agate as possible and also attaining a surface smooth enough for polishing.

Chances are however that your agate is one of the more common specimens with irregular size and shape and only two small areas of pattern showing. It is indeed a rare Fairburn which shows no pattern on the surface. The agates which show two patterns must be examined carefully. One pattern may be quite a little larger than the other. In fact the second pattern might be little more than a dimple with different coloration than the rest of the stone. The two patterns are in reality the surface evidence of but a single pattern. They may be close together or on opposite sides of your specimen. It is the size and arrangement of these two "picture windows" which determines your treatment of a cabinet specimen.

First: If the two patterns are very close together, the pattern most likely runs out fast. It probably does not



"open up" into a large pattern. Your solution is to either grind and polish the larger pattern, or cut a very thin piece from as near to the larger pattern as possible and parallel with the face of the larger pattern. This also applies to opposite patterns with one much larger than the other. (Fig. 1)

Second: If the two patterns are opposite and of nearly the same size cut the agate almost in the center and parallel with the faces. The reason I say "almost" in the center is that a few Fairburns have quartz crystal or amethyst cavities inside and the crystal cavities are prettier if not cut dead center. However the crystal centers are not nearly as common as in the Mexican fortification agates.

Third: If one pattern is of a brighter color than the other the chances are that your agate "opens up" to a large bold and beautiful pattern. The brighter colors carry inside so even if the larger pattern is the least colorful make your cut near to that surface. About half an inch from the larger surface and parallel with it, should be about right.

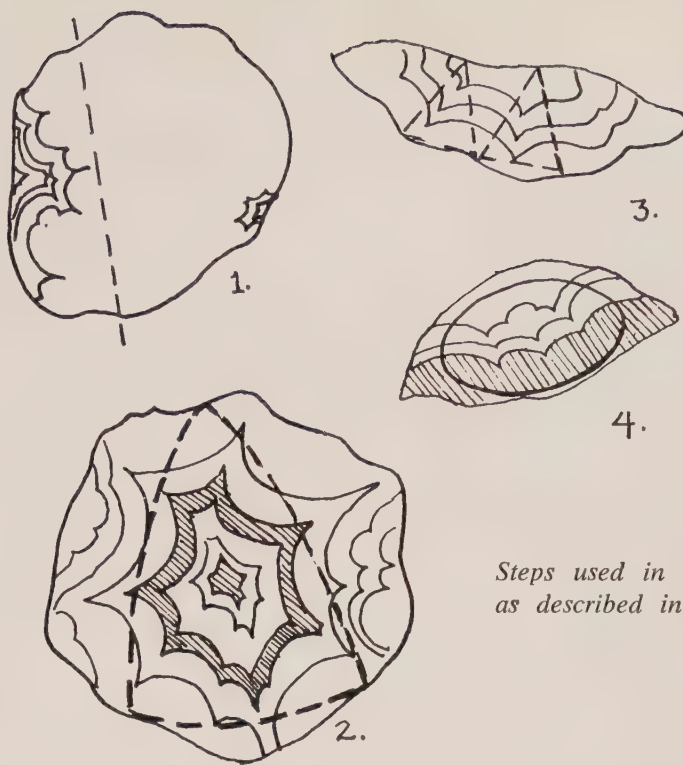
Fourth: Some Fairburns, both small and large have a "wrap around" pattern covering the whole stone. This type is especially prized as they are usually masterpieces of complicated color and design which can be treated several ways with excellent results. Tumble polishing makes a suitable gilding for your lily. Some Nebraska friends sent some of this type of Fairburn away to be tumbled, with specific instructions to leave them whole. Imagine their pain when the agates came back in little pieces with the notation that it was not customary to tumble agates whole!!

The all-over agate can also be ground and polished by hand or even slabbed. With this type of an agate you get a good pattern which ever way you cut, but the preferred way is to find what you consider the center of the pattern and make your cut parallel with it.

Any favorite cutting and polishing procedure will bring a bright finish. We use 220 and 320 sanders followed by a buffing with a well worn 320 sander and finally either tin or cerium oxide on a felt wheel.

Small Fairburns or agates which turn out to be more matrix than agate are suited to jewelry.

Agates up to an inch are better when tumbled. From 1" to 1½" agates are fine for cabochons. However, since the Fairburn is now so rare try to keep the cabs as large as possible. Let the size and shape of your stone govern your cab. A Fairburn just isn't a stone for mass producing conventional sized cabochons. Really a free form design in a mounting especially made for it is the best way to do justice to a good Fairburn.



*Steps used in cutting Fairburn agate as described in accompanying article.*

A cabochon made from a Fairburn agate should use as much of the full pattern as possible. (Fig. 2) Your balance will be better if the center of the pattern is somewhere near the center of your cab. A fairly flat cab shows off a large pattern better than a high domed cab.

Fairburns were named for the town of Fairburn in the badlands of South Dakota. The agates are found in gravel terraces and isolated buttes in scattered points in southwestern South Dakota and northwestern Nebraska, with a few being picked up in Wyoming. They are hard to find now, but for the "do-it-yourselfers" who like to find their own stones, there are still beauties waiting which are well worth your efforts.

Here, where the Fairburn is our most important gem, we can usually tell at a glance not only how to cut the stone but also where it was picked up. The Nebraska agates tend to have a brown jasper matrix. The Pine Ridge agates are often black and white. The brightest colors come from the high table lands near where the agates were first found.

A Fairburn with too much matrix can be slabbed and used for jewelry. Also odds and ends left from cabochons or good sections of an otherwise fractured piece are fine for jewelry. Since it is the brightly colored bands which distinguish a Fairburn, such pieces can be used much as Brazilian banded agate is used. For example, little triangles with horizontal or vertical stripes make interesting ear dangles. (Fig. 3) A scenic cab for a tie pin might be made of a

colorful band or two of agate from the top of the cab and some of the jasper matrix as a base. (Fig. 4)

Some Fairburns are quite quartz. Although these make beautiful specimens they are not desirable for jewelry as the quartz is much harder to polish than the accompanying agate bands. Small quartz agates are perfect for tumble polishing.

Agate transparencies for projection on a screen are becoming a popular branch of the lapidary hobby. A thin slab of Fairburn agate makes an unusual transparency. For this purpose you need a rather small agate in order to be able to use as much of the pattern as possible. Quartz bands or small crystals make your transparency hard to cut and polish but add to the interest of the finished product, particularly if it is amethyst tinted.

The Fairburn agates are not suited to pen bases, book ends, or paper weights. A good Fairburn large enough for such uses is too rare to use for anything but a prize cabinet specimen and many such specimens have brought \$100.00 each or more in the gem markets.

As a matter of fact after all this discourse on how to cut Fairburns I must admit that some of the finest I have ever seen have not been enhanced by man and their present owners have no thought of subjecting them to a "beautification" program. And since these connoisseurs dearly love polished stones this fact alone attests to the beauty of a good Fairburn.



# IRIS AGATE *And Its Treatment*

*By Erna Clark*

To own a few pieces of good iris "rainbow" agate can be your pride and joy forever! If you do not already have some then perhaps you have some neglected dust-covered material in the rough stuck away that could be developed into beautiful iris. Or perhaps this article will inspire you to start right out on a search for some out on the desert, the beaches or in your backyard. (Or even in a collector-friend's backyard . . . that has been known to be highly successful too!) This agate, when developed, has the play of all the colors of the rainbow and therefore many of us know it by the name of "IRIS 'rainbow' AGATE." Some lapidaries like to call this beautiful agate "SPECTRUM AGATE" because it has spectrum qualities . . . hence this infers to this agate any series of radiant energies arranged in order of wave length and brings about the colors from red to all the other colors of the rainbow.

Going back to Greek mythology we first hear of the name Iris as that of the Goddess of the Rainbow. She was the daughter of Thaurus and Electra, who was the sister of the Harpies, the fleet golden wing messenger of servants of the Olympian Gods, especially of Zeus and Hera. In other words Iris was originally the personification of the rainbow.

Will Rogers used to say, "all I know is what I read in the papers." I say that all I know about iris "rainbow" agate is from actual experience gained when assisting my husband (the late Dr. D. H. Clark) in collecting, cutting and polishing this most beautiful of agates. I still cut and polish them when time permits.

When iris is developed, its delicate colors of ethereal-like beauty reminds me of something truly divine. Although the flash of colors in fire opals is similar I prefer the rainbow iris because I can have more real fun playing with it.

Until recent years little was known about iris. Very few collectors had any and pieces were not shown in museums. Contrary to public opinion iris-agate is not a special kind of agate. The phenomena of iris is not produced in agate alone but in many other agencies. An example is the sun shining on a thin sheet of water or against a fine mist of water, or oil on the pavement, and of course our rain-shower bows.

Most of the iris is developed from clear agate that is cut very thin and polished on *both* sides — mostly from nodules without matrix and also from seam-agate. However we also developed some from what is evidently a wood-

cast, from the petrified wood location of Eden Valley, Wyoming. It had quartz centers and was banded—typical characteristics of regular iris.

When we were first introduced to iris agate we were told it was *very rare*. We soon found that to be true and when we were further informed that only an average of one agate in 20,000 has iris it was a real challenge to us to start right out and see how many we could find by digging, buying, begging, trading and (almost) stealing. A locality in Mint Canyon, northeast of Los Angeles, gave us a better average than the quoted figures. Here we averaged about one rainbow in six agates. That is extra good! And we were having fun too. However some collectors have tried and tried for iris from other localities and average only one iris perhaps to a wheelbarrow full or even a ton of cut agates. But I hasten to add that anyone is likely to find iris wherever translucent agates are found, even in seam agate. Sometimes it appears in the first piece you try. That was our experience when we cut an agate nodule I had found near Chuckawalla Springs in Southern California. It has a beautiful band of rainbow colors combined with turtle-back agate and has white plume around the edge. This was the spark that set us off in search for more iris and renewed our enthusiasm for this great hobby.

## HOW TO RECOGNIZE

How does one recognize the characteristics of agates that have the promise of iris? Usually they are without matrix and usually they have a center of massive quartz crystals. Or they are hollow and quartz-lined with the chalcedony bands around the edge in which we find the play of the rainbow coloring when developed. Sometimes these bands are adjacent to the quartz crystal center. However, this characteristic can be reversed, with the bands or fortification lines in the very center of an agate which has radiating quartz crystals around them. The latter are super-duper rare! We found this type on hills in Idaho. There are also a few that are solid chalcedony. These may have iris all over the surface and before a light they resemble a solid piece of fire opal.

The strange phenomenon of rainbow colors in agate is caused by an interference of light. When a promising agate is cut on the long axis, or even across the short axis, it shows distinct bands where the minute layers have been cut. These bands vary a great deal in thickness and may run as many as 55,000 to

the inch. By their ability to refract light the bands cause the rainbow colors. In order to get the proper effect these bands must be within a certain distance apart. This range of distance usually is from 1/22,000th of an inch to 1/12,000th of an inch. If the bands are closer together than 1/22,000th of an inch the agate is so dense that the light rays cannot penetrate it. If the bands are farther apart than 1/12,000th of an inch the agate is so open that the rays pass right through without refraction.

While experimenting for iris we discovered that a thin slice placed under a strong magnifying glass reveals that the bands are also made up of minute quartz crystals which act as prisms and have the ability to refract light causing the phenomenon of true rainbow colors.

If you take a known piece of iris that has been dyed by soaking it in chemicals the iris effect is lost permanently. Experiments with heat treatments on ordinary banded chalcedony have failed to produce the play of rainbow colors. Only Nature can produce an iris-agate!

For maximum results from these hidden beauties it is advisable to take a promising agate and cut slices as thin as 1/8th to 1/16th of an inch. Some of these are paper-thin by the time they are polished on both sides and with beautiful results. Spread a thin smear of kerosene oil on both sides and hold toward a clear light or the sun and play the specimen back and forth or up and down. You will know immediately if it is iris. If it is, then proceed to polish on *both sides*.

## HOW TO POLISH

This is best accomplished by the following method. If there are any jagged bumps on the edge of the slice grind them off on a grinding stone until the piece is smooth. Dop it with sealing wax to a block of wood or a piece of plate-glass approximately the size of the piece to be polished and thick enough for easy handling. The backs of old scrub-brushes or smaller brushes are ideal because they fit the hand. Another method is to dop the slice to another big agate so that the big agate takes a lot of the generated heat. First melt enough sealing wax for a smooth spread over the entire top of the block to be used. At the same time warm the slice and place it on the warm sealing wax, extending the slice 1/4" on one end. Allow the work to cool thoroughly. You are now ready for the next step. Start off by using 220 grit. If you have a smooth cut stay with this grit until all saw marks are ground away and do not press too



hard. *Avoid overheating!* Now you are ready for the sander and after that you finish off with cerium oxide for the final polish. In other words process agates in the conventional manner as for cabochons. I know of one expert iris-polisher who uses the "feather-touch" system of merely holding the thin slice in the palm of the hand. I am still afraid to try it with anything so delicate and rare as iris.

Now the all important question on how to remove the sealed slice without injury. Place it in a pan of cold tap water. This usually causes the slice to drop off. If it does not then add a few cubes of ice or even place the work in the refrigerator for a few minutes. Then the slice can be pried off with a little pressure or a gentle tapping on the *extended* end. Take care not to leave it in a refrigerator too long or it will cause too much contraction if the specimen has a minor fracture. Do not tap on the side edges of a slice for on a slightly fractured piece this might cause disastrous results.

To remove surplus wax we use alcohol or turpentine, but upon recent information I experimented and learned that there is nothing like acetone for that purpose. This is the chief ingredient of nail polish remover and is available at drugstores. It should be kept in an old perfume bottle that has a ground glass stopper. This prevents evaporation.

Now with both sides polished you have something unusual and beautiful! A new "bragstone" to play with, at arm's length up and down before a light or the sunshine. A clear electric globe is best for maximum results.

Some collectors mount their iris in frames of cardboard for easier handling and with less danger of breakage. Others glue them lightly on thin window glass and paint green or black enamel between the specimens to cut out surplus light. Others use the reflection of a mirror and lights. Part of my collection is displayed in an octagon-shaped cabinet with lights inside. The cabinet, geared to a small motor, revolves automatically. It was a gift from a good friend, an expert cabinet-maker and the finest type of collector who introduced us to the marvels and wonders of iris-rainbow-agate.

To own a piece of iris that includes a landscape scene plus a "rainbow" is to own something priceless! By that I mean the owner seldom lets go of it—not until his time is about up on this good earth with its rainbows and then he might give it to some very special person as a "treasure gift."

#### WHERE TO GET IT

Here is a list of known locations for good iris material:

—Moss agates from the banks of Yellowstone River in Montana.

—Along the Willamette River and the coast beaches of Oregon.

—Some of the very best iris agates come from near Antelope, Oregon.

—Agate nodules from throughout Wyoming.

—Agate nodules from Challis, Idaho.

—New Mexico (near Springerville, Arizona).

—California locations: Mint Canyon agates, northeast of Los Angeles; Chuckawalla Springs east of Salton Sea or near Desert Center; Nipomo agates (some including sagenite) 3 miles north of Santa Maria; Berkeley Hills along Fish Ranch road; Twenty-

nine Palms district and Lavic, on the Mojave Desert.

—Big Bend, Texas district and Old Mexico locations.

—Brazilian agates have produced some very beautiful iris.

So we learn that one is likely to find iris wherever agates can be found. Perhaps many of you already have some of this material on hand and now, you should proceed to develop it. Even if all agate does not turn out to be iris you will find specimens with very pretty fortifications to start a collection of translucents that are very beautiful in their own right.

## Connecticut Agate Locations

*By Norman P. Walker*

I wonder how many rockhounds ever heard of agate, jasp-agate, or combinations of both from Connecticut? We do have them but gem quality stones are very scarce.

When I was stationed at Medford, Oregon, and Fort Lewis, Washington, during World War II my interest in collecting gemstones started. I collected some 150 pounds of agates, jaspers, petrified woods, etc. and brought them back to Connecticut when I was discharged in 1946.

As time went on I wondered if one could find these rockhound items in Connecticut. Getting several books from the library on Connecticut history, and others on Connecticut geology, did not help much. I returned to the library and asked to see some state bulletins on Connecticut minerals. At last I found something to go on. Bulletin 77, *State Geological and Natural History Survey*, by Julian A. Sohon of the Bridgeport Public Library, gave me my first information that agate had been found in Connecticut.

Listed under quartz varieties was not only agate, but jasper, carnelian, bloodstone and several other varieties of the quartz family gems. Much to my amazement eleven towns were listed where agate had been found and six towns where jasper had been found.

Armed with this information I was ready for my first field trip. Oddly enough, most all the agate locations were in the western part of the state and within an hour's driving time from my home town of Shelton. Traveling to Southbury, a small town southwest of Waterbury, was my first experience at finding agate in Connecticut. It was here I found a red moss agate and some clear varieties along with one large one with a crystalline center.

Not having too much luck in Southbury, my next jaunt was to East Haven

where several references to agate had been made. "Casing the town," I started walking along the shore where there was plenty of rocks. I did not find a single one despite all the references to this section of New Haven.

Working on a hunch, I went over to West Haven and again followed the same procedure. My hunch paid off for gems were there and in a six-mile stretch from West Haven to the town of Milford I found my best specimens. In West Haven I found a few top grade agates, jasp-agates, and jasper of good gem quality, some pieces with mineral inclusions. I also found several jasper conglomerates, agate conglomerates, and some orbicular red and yellow jasper. A few pastel shades and some banded agate were gathered. One agate conglomerate I found looks like the Oregon type of gray-blue, splotchy pattern with white agate around the edges of the patterns. It also has a black mineral inclusion.

Further down the coast from West Haven, the town of Milford has about the same variety. A few poor grades of lacy agate have shown up. There are quite a few jasper conglomerates in the town of Milford.

Farmington, another small town southwest of Hartford, has shown signs of having agates. I have only visited this location once so I have little information to offer other than to say it is a good place to explore.

Several other towns in Connecticut have reference to agate but I have not had the time to make visits to them. This about sums up my agate, jasp-agate, and conglomerate findings in Connecticut to date.

As far as I know Connecticut has no deposit of agate *in situ* but it is scattered in various places as float, mostly in the western section of the state. It is my intention to continue searching Connecticut for rockhound material.



# FIRE AGATE of California

*By Joseph W. Baker*

*The area described in the following article is a marvelous area for the rockhound but it is positively no place to visit between the first of June and the first of October. Army engineers testing the area last summer, found the ground temperatures often in excess of 130°. There is no water in the area at all. If you do go there in the summer, do not go alone but have another car accompany you.*

One of the real old time rock collectors is responsible for the discovery of Fire Agate. Many of you reading this know him and those that know him love him for his enthusiasm. I have never met him, yet our paths have crossed many times. Perhaps the day will soon come when I will meet Mr. C. E. Squires of Orange, California.

The story comes to me second hand and I will tell it as I have been able to piece it together. It seems that Mr. Squires had been to the Hauser Beds many times looking for geodes. The same type of formation is in the Black Hills. Mr. Squires was attracted by the prospect of rich geode fields; the discovery of the iridescent fire was quite by accident. Just the natural curiosity of a good rockhound examining another field—looking it over thoroughly.

Mr. Squires then introduced his friends, Mr. Ed Rochester and Mr. Earl Kerr, of Picacho and Winterhaven, California to the field. It was Ed and Earl who actually extended the field to its limits and filed the original claim. The original material was gathered, as nearly as I can find out, in the fall of 1945 or the spring of 1946. Rochester and Kerr filed their claim in 1947, this being a placer claim. Anyone else thinking they own a claim on the Fire Agate beds of the Black Hills of southern Riverside County, California are just claim jumpers unless they can prove prior filing to 1947.

It was Rochester who sent material to the American Museum of Natural History for identification. Dr. Pough identified both the basic rock and the material causing the iridescence. Mr. Squires, as I understand it, has many beautiful specimens of Fire Agate, but Kerr and Rochester have the largest collection of spectacular pieces by far of anyone.

Maybe you don't like the name Fire Agate but call it what you will, it is still one of the most beautiful of semi-precious stones. Some call it Agate Opal. It isn't opal so this isn't correct. Some call it Black Hills Agate, as it comes from the Black Hills. The other day someone called it Three Mile Agate for some reason I haven't found out. I like Fire Agate the best for it more fittingly describes the stone. For this



*Example of fire agate showing cabochon with sagenite.*

gem has fire, *deep fire*; not the fire of the opal but deep flashing fire of breathless beauty. The fires of all the ferric colors, reds of every hue, greens, yellows, and lavender. Think of any color and Fire Agate has it in pure hue.

Are you a stickler for identification? Then it isn't agate at all, it's chalcedony. Chalcedony deposited over the centuries by surface waters slowly dissolving silica and carrying it down, down into the earth to be left off in thin layers on the walls of cracks in the solid rock.

The fire that makes this chalcedony unique, beautiful beyond description and highly prized, is limonite — iridescent limonite. Limonite is a difficult thing to define. We should call it an oxide of iron and stop there. It is of secondary origin and very common the world over. The very color of the whole southwest is limonite. Most references claim limonite has no crystal form. All agree that the colors of limonite are limitless.

Fire Agate closely approaches crystalline quartz in hardness. The layers are so thin that this material is a regular nightmare to grind into shape. Look at the layers under a microscope and there you will see thousands to the inch. All

*Lower—Some fine examples of fire agates from collections of Ed Rochester and Earl Kerr.*



this layering follows a botryoidal effect and if one is very careful to follow the natural curvature of the layer containing the fire, his rewards will be rich indeed. *Don't saw Fire Agate—Grind it!*

I took a specimen to the Arizona Bureau of Mines several years ago and it was there that I learned the actual nature of the gem. The basic stone is chalcedony and the iridescence is caused by limonite. This agrees with the classification sent Mr. Rochester from the American Museum of Natural History. A friend of mine sent a piece to the Smithsonian Institution and was informed that the Institution knew of no other deposit. I do know of two other areas where Fire Agate has been found, but nothing that will compare with the beauty of the Black Hills variety.

There are several ways to get to the "diggings." One is from the south on the Ogilby-Blythe Road. This road connects H. W. 80 on the south, 5 miles south of Ogilby, California, with H. W. 60-70 at Blythe, California, on the northern terminus. The main road from Blythe to Ogilby is generally kept in good condition. About midway between the two towns is a water source that can be used all year, called, aptly enough, Midway Well. Five miles north of this well is a very wide wash — Milpitas Wash. It is on the north side of this wash that we leave the main road and get on an old army road that will take us for the next 23 miles in a westerly direction and slightly north. Drive with caution on this road ("General Patton's Highway,") for a rain is likely to leave a 24 inch deep gully with no caution signs. A shovel is mandatory equipment on this trip. The entrance to Coon Hollow (the name of the camping grounds) is a mile beyond the Hauser geode bed road. A mile to the northwest that would be. The Coon Hollow road swings off to the right for two miles and drops into the quiet little camping ground that it partially protected from the winds. This area is well camped in but is fairly clean. This speaks well for the rockhounds when one considers the vast number that have camped here in search of the sparkling Fire Agate. Needless to add — take your own fire wood.

The actual "diggings" are two miles east of the Camp Grounds and the clearly defined, well worn trail seems to me to be up-hill both going and coming. The Chalcedony is found scattered over the surface for miles around but only on the one hill or mountain does it seem to contain just the right amount of fire. It is to this mountain



that the well worn trail leads, and it is here that the Rochester and Kerr claim was filed. The parent rock, an old lava and tuff, is well weathered and easy to dig in if one feels eager enough to lug a pick and shovel. A couple of gallons of water will help to moisten specimens for better inspection of their fire possibilities. Perhaps you will not need the water; maybe you are an old calloused tongue like myself. Much of the material will be coated with an almost

opaque brown coating. Close inspection is the trick; don't crush up every piece with your hammer. Be a rockhound and not a rock crusher.

A few pieces have been found containing sagenite. Rarely, the sagenite may be coated with iridescent limonite making a sagenite Fire Agate. Here indeed is a rare and beautiful jewel.

A bit more about the cutting: I said *grind*—don't *saw*. Grind ever so slowly, looking often. Be careful not to get your

stone too hot, it may come apart at the layers. If you are so unfortunate as to grind too heavily and ruin a beautiful layer of fire, don't throw the stone away. Grind deeper and another layer of fire may appear. This isn't always the rule but sometimes it works. Remember when grinding to try to follow the shape of the layer with the fire. Odd shaped cabochons will be the rule rather than the exception for the spectacular Fire Agate.

## GOLD IN QUARTZ

*By Clyde L. Browning*

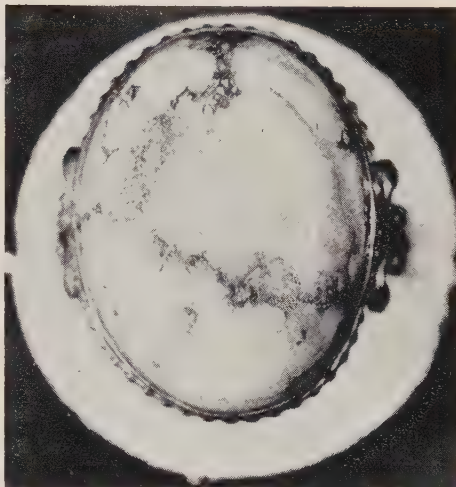
How many priceless gems of Native California Gold Quartz went through the crushers and stamp mills during the era of gold production in California? No doubt if one could have saved some of this high grade gold ore there could have been many valuable gems cut from it. But instead it was crushed in the merciless stamp mills for its gold content only.

The photos will serve to show what I mean. These are examples of gem gold quartz that escaped the fate of most of the ore that went through the stamps.

My friend, a retired mining engineer, knowing I was a lapidary asked if I could cut a gem stone from gold quartz? I assured him that it could be done provided the quartz was sound and free from flaws or fractures.

The stone he presented for cutting was the size of a medium size lemon and about the same shape but not quite so yellow, though it did contain several ounces of gold. I studied the stone carefully for some time and finally decided to cut parallel to the most of the flaws that I could see and let the chips fall where they may. The gold pattern was about the same on all sides so there was little choice in that respect.

The cuts were made to produce a five thirty-seconds inch slice, the thickness thought to be needed for the cabochon expected would be quite large. The extra thickness might also help to keep the slabs from falling apart due to flaws. The results were gratifying in that respect as the slabs had very few flaws and they were partly healed. My friend presented me with one of the slices and the "heel" or first cut. From these I made a bola tie of the heel, and from the slice I cut two cabochons, one a dinner ring, the other a lovely pendant. The gold pattern in the pendant resembles a tree with considerable dark mineralization around the base of the tree. The stone

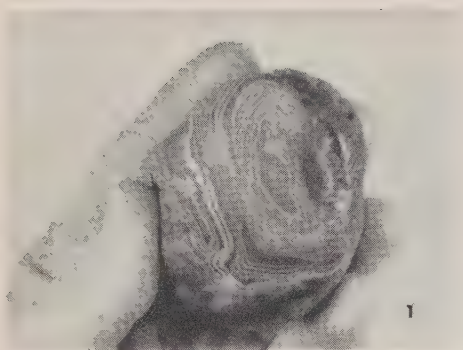


is practically flawless, about one and one-eighth inches long.

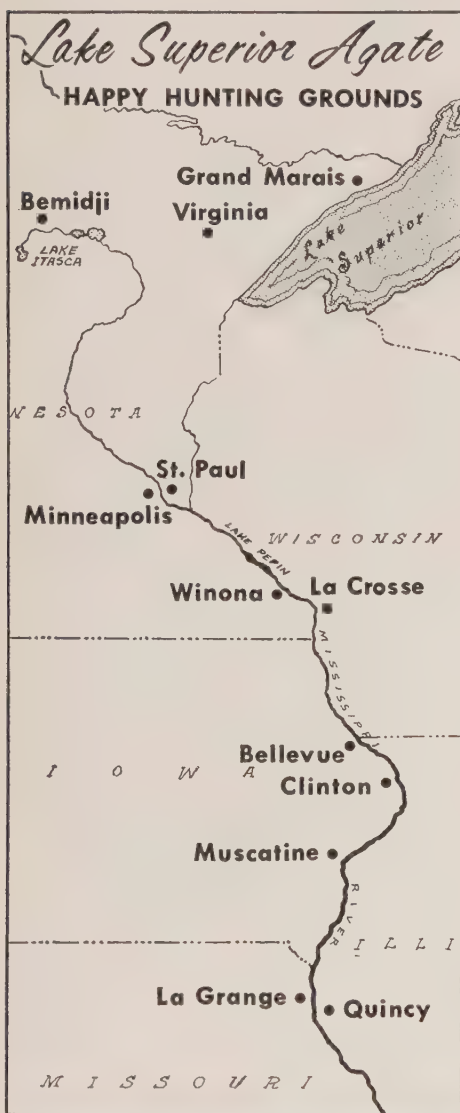
The prize gem of all was the pendant made for my friend's daughter. The cabochon finished about one and one-half inches long and about one inch wide mounted in a plain fourteen karat gold band and hung from three chains. The beautiful gold pattern of this pendant resembles a Chinese dragon climbing a wall or if viewed horizontally, he's just ambling along, like any lazy dragon.

I was sure when the gem was finished it would be highly prized by its owner. The test came when her employer, a wholesale jeweler, offered a one carat blue white diamond in her choice of mounting in exchange for the gold quartz pendant; of course, her answer was "No. The pendant was a gift from my father and his friend who cut and mounted it for me."





This fine Lake Superior Agate represents a half pound of superb pattern and exquisite colors. J-1.



# For pattern and color LAKE SUPERIOR AGATES are in a class by themselves

By J. Lester Cunningham

228 N. La Salle Street, Chicago 1, Illinois

Photos by Marge Cunningham

All jewelry designed and made by the authors

\* \* \* \*

AN ASSIST FROM: ROCK HUNTING—U.S.A.

Much of the material for this article was taken from Rock Hunting—U.S.A., Chapters I and II, Lake Superior Agates, by Marge and Les Cunningham.

In brief, Rockhunting—U.S.A. is the name the Cunninghams have given to a large assortment of color photographs they have taken at the many famous rock hunting locations visited in their travels during the last ten years.

The whole collection of color slides is comparable to a book. And, the pictures for each rock hunting location make up the individual chapters. Already 23 such chapters have been recorded on film, and additional new chapters are added each year.

At each rock hunting location they photograph the locale as well as the actual diggings. They also take pictures of the gem material collected, and later, the slabs, the cabs, and the jewelry that is eventually made. They then write the script, tape record it to synchronize with the slides, give it an appropriate title, and another chapter is complete.

Many who have seen some of these chapters when presented before lapidary clubs and rockhound conventions have been most complimentary in their comments. We wish it were possible to present the two chapters on Lake Superior Agates on these pages—in full color and with sound effects. But, of course, that is physically impossible. So we asked the Cunninghams to adapt the material for use in this All Agate Issue of the Journal which they most obligingly did.

The Editor

\* \* \* \*

Approximately 26 miles southwest of Paul Bunyan's northern Minnesota hometown of Bemidji, on U.S. 71, there is a large, highway department sign on the side of the road which points the way to the headwaters of the Mississippi River.

A short distance beyond is the entrance to Itasca State Park within whose boundaries is Lake Itasca, birthplace of the Mississippi. Here, 1,475 feet above sea level, Old Man River begins his winding journey 2,552 miles south to the Gulf of Mexico.

If you visit the park it may be hard for you to realize that the shallow little stream which you'll see lazily flowing from Lake Itasca is the humble beginning of one of the world's greatest waterways—the mighty Mississippi. Along

more than a thousand miles of its shores, from north of Minneapolis, Minnesota, to as far south as Quincy, Illinois, Lake Superior Agates are found in the numerous gravel deposits which dot the entire distance.

For well over half a century, legions of rockhounds from not only the Midwest but from all over the United States, as well as the four corners of the world, have hunted in the well-known collecting areas, many of which are shown on the adjoining map. Together, they have filled their collective rock bags with an incredible assortment of Lake Superior Agates. And, many of these relatively small agate nodules were eventually converted into truly gorgeous jewels, with such distinctly different characteristics that they have a remarkably high degree



← Here's a white fortification pattern in an amber colored background. J-2.

Above—These five Lake Superior cabochons are a rainbow array of colors—reds, creams, browns, whites, tans, and grays.



of appeal and desirability.

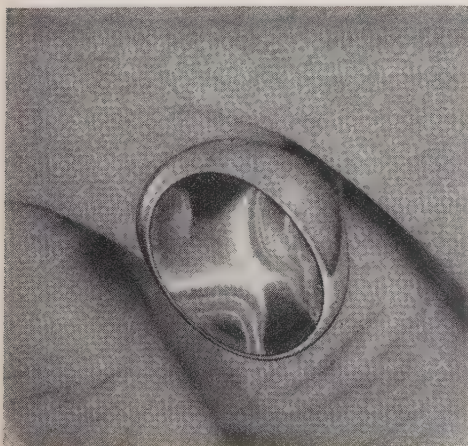
To many of us who have hunted them, and particularly some of us who have enjoyed the satisfaction of transforming them into beautiful cabochons, Lake Superior Agates have strong, fascinating qualities about them. And, these alluring qualities pull us back to the happy hunting grounds, again and again, always with the keen expectation of finding bigger and better Lake Superiors out of which we can cut and polish larger and more beautiful cabochons.

I'd only be guessing if I attempted to estimate just how many Lake Superiors I've found in our numerous expeditions to practically all the collecting areas during the last 15 years. But I'm sure the total number would run well into four figures. However, during that time I know I have cut and polished hundreds of Lake Superiors of all sizes, types, patterns, and colors which I've used for different purposes. For example, I have a nice, representative collection made up of 275 cabs of various dimensions, shapes, and descriptions, a number of which are real beauties. Several polished pieces from this collection are illustrated on the color spread shown on page 48 and 49.

Early last year I completed another collection consisting of 101 cabochons cut from the most unusual Lake Superior Agates I have ever been able to get my hands on. I have other similar collections of cabs cut from Jade; Petrified Wood; Agates from all over the United States, Canada, and Mexico; Australian Opal; and many other gem materials—but the 101 unusual Lake Superiors rank tops with me because of the superb pattern and exquisite color combinations which are revealed in the cabochons.

Obviously, Lake Superior Agate cabochons are also ideally suited for use in jewelry. And, some of the best which I have cut and polished have been used for that purpose, a few examples of which are shown on these pages. Lake Superiors look equally attractive when set in either sterling silver, silver and copper, or gold. And because of their

*A dozen reds, dark to light, border the white center in this ring. J-3.*

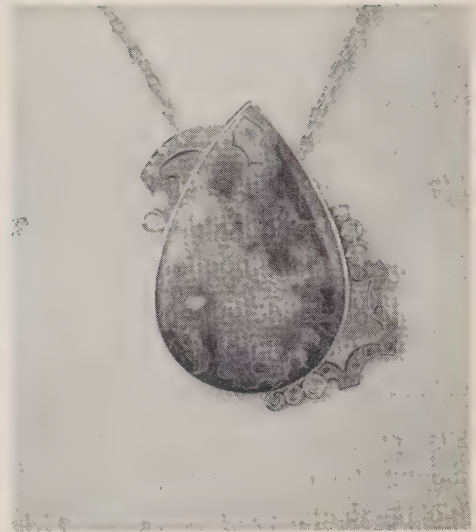


*Note how ring design matches the exotic pattern in the cabochon. J-4.*

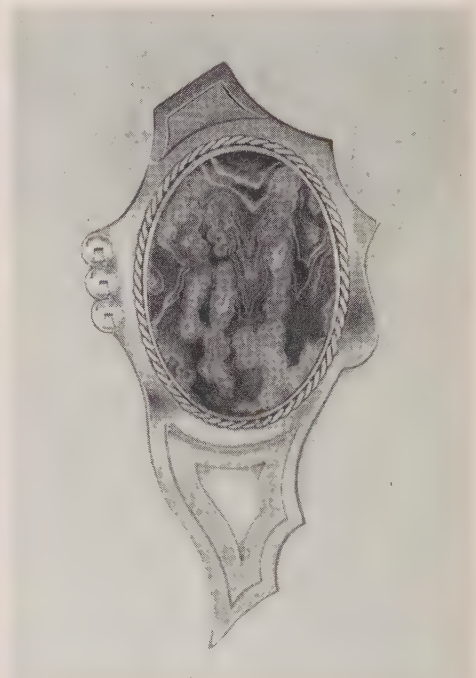
hardness they are very durable and will withstand a surprising amount of use, and even abuse. The cabochon shown in the ring in Photo J3 is a veteran of 14 years of constant daily use. I've worn it so consistently that it is now almost like a trade mark. Two years ago the original, 18 gauge sterling silver setting finally wore out and I had to make a duplicate. Yet the cab is still as bright and shiny today as it was when I took it off the dop stick one evening in January, back in 1948.

By now it should be quite apparent that your author has a very high regard for Lake Superior Agates. And, that I have. To me they are not just stones with gem quality, along. Instead, for me they have character, they have personality, and they have individuality, in addition. And, once you become fully aware of the extra high quality gem possibilities these three extra attributes seem to give them your interest in them, like mine, will almost certainly increase with each one you cut and polish. I'm sure that my fondness for them is not singular. There are at least hundreds and more likely even thousands of other

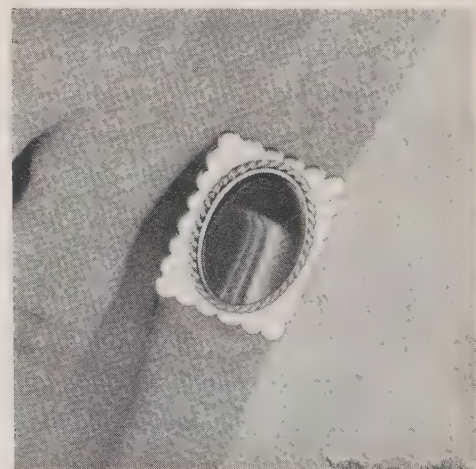
*Reds, whites, browns, creams are the color scheme in this cabochon. J-5.*



*Again the pattern elements in the cabochon were used to create another original matching jewelry design. J-6.*



*Coloration in this cab gives it a third dimension effect. The light reds and browns, surrounding the dark reds and white formation at the top, darken in shade as they move downward. J-7.*



*Movement, such as cascading water, seems to be portrayed by the many red and white tones in this cab. J-8.*



rockhounds who share my enthusiasm.

Small wonder then that the number of Lake Superior Agate hunters grows steadily, year after year. Regardless of the day of the week . . . or . . . the season of the year, when hunting is possible—you'll seldom be alone very long wherever you hunt Lake Superiors. Instead, you are almost sure to be joined by other rockhounds, if they are not already there gleaning the gravel, when you arrive. Some will be youngsters, not yet in their teens. Others will be oldsters with white hair, or no hair at all. Some will be newcomers to the rockhound fraternity, others will be old timers who have hunted for years. Both sexes will be equally represented. All of them will have one thing in common with you. Each one will be just as eager to find some really good Lake Superiors as you are, and you can be certain of that.

What they are all hoping to find is Lake Superiors like the one I'm holding in Photo 1. This one is a very fine specimen, indeed. It has a well defined banded pattern, and the pattern is centered, which generally means that it will continue deep into the nodule. The color on the outer edges is a rich, rust-red carnelian. Next comes a series of alternating bands in white and red. These decrease in intensity as they approach the center which has a fortification pattern, the interior of which is a pale amber color. This particular Lake Superior Agate measures 2- $\frac{3}{4}$ " from top to bottom and is 1- $\frac{5}{8}$ " thick through the middle. It weighs half a pound.

The only reason why Marge was able to take a picture of this unusually choice Lake Superior is because long ago I decided I would keep it forever intact, just as I found it in the commercial gravel pit at Winona, Minnesota. Everytime I look at it my pulse quickens when I think that it must have brothers and sisters like it who are waiting for me to find them and give them a good home. There'll always be plenty of room at the Cunningham's for such additions.

In the main, however, the majority of Lake Superior Agates found at any of the locations is relatively small when compared with other nodular material. Usually they run  $\frac{1}{4}$ ",  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", 1", 1- $\frac{1}{4}$ ", 1- $\frac{1}{2}$ ", 1- $\frac{3}{4}$ ", up to 2" in size. Based on our own experience in the field, the bulk of those you'll usually find ranges between  $\frac{1}{4}$ " and 1- $\frac{1}{2}$ " in length. In some localities there are many peewees under  $\frac{1}{4}$ " but a large percentage of them are too small for practical lapidary purposes, except possibly tumbling, which is what we do with them.

Unlike so much other gem material which you can buy in solid chunks by the pound—it takes 24 to 30 average 1" Lake Superiors to make up a pound. A one pound round coffee can will hold roughly 3- $\frac{3}{4}$  pounds of average, field run, mixed size Lake Superiors, give or

take an ounce or two. Since Lake Superior Agates do not come in bunches like grapes you have to hunt them out individually, one at a time. And, quite often there is a lengthy gap between each find. Consequently, anytime you can fill a one pound coffee can to the top in a day's hunting you have every right to feel that you have earned your salt. At any rate, that's the way we feel, and I think many other experienced Lake Superior Agate hunters will nod in agreement.

Lake Superiors that measure over 2" in size are not rare but let me hasten to assure you that they are anything but numerous. Whenever we find one that measures in excess of 2" we think the day is practically a success—especially if it is good gem quality. Generally, the larger the size over 2" the fewer you'll find, *regardless* of where you do your hunting for Lake Superiors.

In our travels up, down, and all around the hunting grounds we have been privileged to gaze upon a few Lake Superiors with king size proportions. These we looked at with both awe and reverence. The largest we have ever seen tipped the beam at 12 pounds. It is not only a giant in size but it is also top gem quality, to boot. What few Lake Superiors there are with anything near such specifications are genuine museum pieces, except that few museums have them because the finders simply cannot be induced to part with them for honor, glory, folding money, or any other consideration.

The largest Lake Superior Agate we have weighs exactly 6 pounds. It has a brick red carnelian color over all. Although it does not exhibit a large banded pattern on the surface there are numerous small-pattern formations scattered here and there all over the nodule. It's every ounce a Lake Superior but what's inside is anybody's guess—and almost everyone who sees it likes to speculate on what the interior contains. We do, too, but we're going to keep it just as it is. Thus we can continue to put it on display when we present programs on Lake Superior Agates before gem and mineral groups where so many seem to enjoy just looking at it and guessing.

Our 6 pound Lake Superior came to us as a gift from a long-time, very good rockhound friend who found it in an open iron ore pit in the neighborhood of Virginia, Minnesota. We've hunted with him and others in various spots in the same vicinity and also around Grand Marais, Minnesota, on the north shore of Lake Superior, but we have never come anywhere near to finding such a whopper.

The biggest Lake Superior we have found so far weighed 1 pound, 1 ounce. And eagle-eyed Marge found that one on a gravel pile at Muscatine, Iowa, one bleak, snowy Saturday afternoon late in November, five years ago. We were chilled to the marrow and had just about

decided to call it a day when Mrs. C. let out a lusty whoop and holler announcing her extra-ordinary find. Our thermal reactions to such good fortune made us forget our numbed exteriors and we renewed our hunting with all the zeal of a cub insurance salesman chasing down his first likely prospect. But apparently all sensible Lake Superior Agates had taken cover because, although we kept at it until it got dark, we didn't find another one of any size.

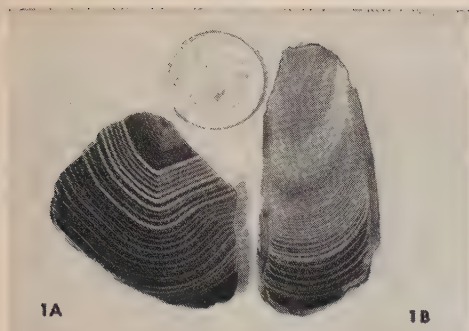
The wide and ever increasing popularity of Lake Superior Agates for practically all lapidary purposes is most likely due to two outstanding major characteristics. And these are amply augmented by a number of highly essential secondary factors—each of which makes an important contribution to their almost universal appeal and desirability.

The first of these two major characteristics is—pattern. Probably no other cabochon gem material found anywhere in the world compares with Lake Superior Agate for such singularly unique, distinctive, simple and complex pattern. This is a broad statement. And, it covers a lot of territory. Nevertheless, I think comparison will prove its validity. Certainly Mother Nature seems to have gone all out in specifying pattern for Lake Superiors. The variety appears to be endless. No two are ever exactly alike. Yet, strangely enough, most Lake Superior Agates have a characteristic similarity of pattern about them, in greater or lesser degree, which almost always helps to identify them as Lake Superiors.

Of course I know there are exceptions but they are relatively quite rare. I have some Lake Superior cabochons which look like anything but Lake Superiors. And, I also have some cabochons cut from a number of other gem materials which look more like Lake Superiors than some Lake Superiors do. Both would perhaps make even some of the experts scratch their heads in trying to identify them correctly. These unconforming exceptions, however, represent possibly less than 56/100% of the material from which they were cut. My comments are confined only to the other 99 44/100% pure conformists.

The most basic and prevalent characteristic Lake Superior Agate pattern consists of parallel or divergent lines of alternating color. These lines or bands may be of different colors, or they may be of various shades of the same color. Sometimes the lines are very fine and close together, sometimes broader and farther apart. But almost invariably you'll find this banded pattern somewhere in the overall design, in one form or another. The two slices labeled 1A and 1B are typical examples. From this starting point Lake Superior pattern seems to fan out in all directions, but almost always following one central theme.





*Reds and whites alternate in 1A, while 1B is light to medium pleasing gray.*



*Deep brown and white alternate in 3A. Reds, in 3B, neatly border the whites*

Lake Superior Agate banding and also that the central theme of arcs and angles is very much in evidence in each.



*Sign board reds with whites are in 6A, and lighter shades plus brown, in 6B.*

Mother Nature must have had a course in geometry and liked the subject very much because geometric symmetry is quite obviously the central theme followed in Lake Superior Agate pattern design. All kinds of arcs and angles and a multiple combination thereof are abundantly employed. Some Lake Superior Agate patterns consist of only a few elements, and these are unified with classic simplicity. At the opposite end of the pattern array are those which embody multiple elements, and these are combined in an extremely complex manner that rivals and often surpasses the ultra modern in design sophistication.

Slice 2A illustrates a simple but very attractive Lake Superior pattern. Notice that it is essentially a rectangle, with a

Also notice that both these slices contain almost a full agate pattern which facilitates centering the pattern in the cabochon.

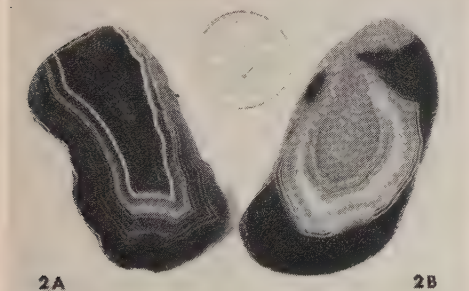
Imagine what an attractive, oval shaped pendant cab could be cut from

Slices 6A and 6B were included in this series to show two excellent examples of how really complicated some Lake Superior Agate patterns are. I would say that each one has an ultra modern sophisticated air about it, wouldn't you? Yet, unlike 5A and 5B, which are so dissimilar, these two have much in common, even though they too are relatively different. Each has sweeping curves, each has prominent broad bands flanked by fine banding, and each has a design with directional quality. Lake Superiors with patterns like these are few and far between.

Like many other gem materials, some Lake Superior Agates can be classified into broad, general types, determined mainly by their dominant pattern features. As far as I know, however, no one has yet come up with an all inclusive list of pattern classifications which is practical, universally accepted, and in wide common use. It seems unlikely that such a list will ever be compiled and adopted because so many Lake Superiors have such complex, multiple type patterns that they virtually prohibit specific classification of any kind.

Over the years I've spent considerable time and effort on the subject and have compiled a list which to date includes 33 different types of Lake Superior Agates. While I sometimes use these 33 types in sorting Lake Superiors into specific categories based primarily on their predominant pattern features, the list is far from being anywhere near perfect or practical. Usually after each such sorting I have more agates still left in the unclassified group than those which I was able to assign to the various 33 different types. Perhaps, as already pointed out, it will ever be thus for the plain and simple reason that a large percentage of Lake Superiors have such widely different, complex pattern combinations that they just about defy regimentation into so many definite ranks and files.

Nevertheless I have come up with an abbreviated list of broad Lake Superior Agate pattern types which I find quite useful, especially in appraising the lapi-



*2A colors are shades of red and white. 2B is white and gray on light brown.*



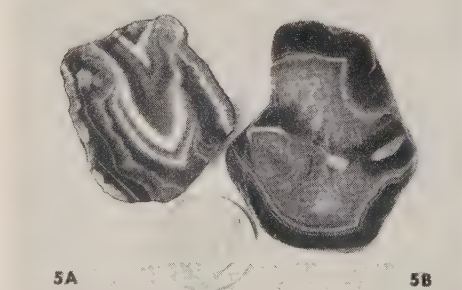
*Slice 4 is a beautiful composition in lively bright reds and frothy whites.*

slice 4. The island centered at the top of the lake, the lake itself, and the shoreline of the mainland with breakers rolling in combine to present a nautical scene in Lake Superior Agate. The chevron banded outlet at the bottom of the slice completes the picture. Well centered, formally balanced patterns such as this are not common but they do occur every once in awhile.

Look closely at slices 5A and 5B. Each contains more elements and their placement is more complicated than that

few curved variations. Equally simple but still quite different is the pleasing pattern contained in slice 2B. This one is basically oval, made more interesting with a few angular additions here and there. Both of these patterns are quite numerous but each is nevertheless different from every other one, in one way or another.

An excellent example of divergent banding is exhibited in slice 3A. Observe, too, that the bands are farther apart than those in 1A, 1B, 2A, and 2B, which gives the impression of strength. In contrast, the fine, close banding in 3B adds a light, delicate, almost feminine touch to the pattern. These are points to keep in mind when selecting Lake Superiors for jewelry purposes.



*Whites, reds, browns stand out in 5A. 5B is red, white, and a light red spot.*

in any of the slices illustrated up to this point. Now note how dissimilar the two patterns are. Actually, they are completely different. Yet, observe that each slice includes some of the characteristic

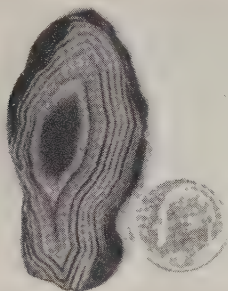


dary potentialities of those we find. In the field, while we're hunting, and also in my home shop, when I'm sorting, the types included in this short list enable me to quickly spot those which I know from experience are particularly choice and therefore should be singled out for special consideration.

There is nothing original or exclusive about the various types in this abbreviated list. Most of them are well known and commonly used in typing all kinds of other rough cabochon material. Consequently they require little explanation. I pass these 10 pattern types along to you because they may also help you in picking out at least some of the higher grade Lake Superiors the minute you see them.

- 1-Full Pattern
- 2-Partial Pattern
- 3-Fortification
- 4-Banded Pattern
- 5-Combination Pattern
- 6-Onyx
- 7-Moss
- 8-Tube
- 9-Eye
- 10-Sagenite

In the full pattern type I include all those Lake Superiors which resemble the slice labeled 7. It's always a thrilling



In 7, successive bands of deep red and white encircle the lighter red center.

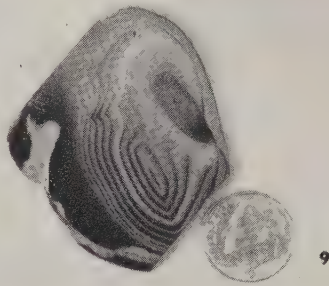
experience to find a nodule which gives outward evidence of possibly possessing a well defined complete pattern through the interior. Naturally you begin to visualize the beautiful slices you expect to get when you slice the nodule on your diamond saw. But, don't let your hopes mount too high—the pattern may be mainly on the surface and not carry very far into the nodule.



The color scheme in both 8A and 8B is deep red, white, mid-red, light red.

Two more fine examples of the full pattern type are shown in slices 8A and 8B, both of which are quite different in appearance from slice 7. These three emphasize the wide variation in pattern that is encountered in Lake Superiors, even when they are all of the same type. Think of what attractive cabochons 8A and 8B would make. Notice the arrow that seems to have been shot into the center of 8B. In a cab—it would be outstanding. Also refer back to 2B, 3A, and 3B.

Partial patterns, similar to the slice identified as 9, are more numerous than the full pattern type. But even though



Alternate bands of rich brown, cream, and light brown in 9 have eye appeal.

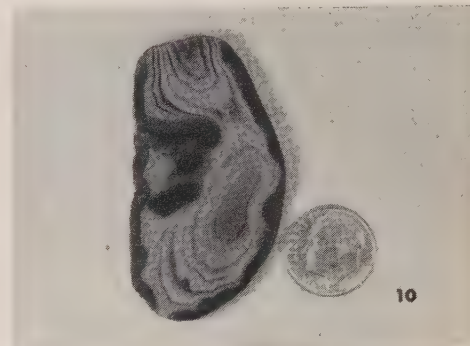
the pattern may not be complete this partial type does not lack for beauty and attractiveness. For example, think for a moment what could be done with slice 9. It offers several interesting possibilities, depending on how you orient the pattern, or sections of it, in your cabochon. For other good examples of partial patterns see 2A, 4, 5A, 6A, 6B.

One of the most popular types of agate pattern is the fortification type, and especially so in Lake Superior Agate. Obviously, the militaristic designation comes from the fact that the pattern resembles a bird's eye view of the outline of an old style fort. The slice labeled 8B, in addition to being full pattern, is also a good example of what is meant by the fortification type. Lake Superiors with such patterns are really choice, particularly if the fortification is complete and can be centered in the cabochon. If you'll turn back to the opening page of this article you will see a fine Lake Superior fortification pattern in the pendant illustrated in Photo J1. Another dandy is shown in the second section of the bracelet in Photo J2.

Two excellent examples of the Lake Superior banded type are, of course, shown in slices 1A and 1B. In these the pattern is all banding, nothing else. Very striking cabs can easily be fashioned from this type since there are no pattern orienting problems to contend with. All you have to do is decide how you'd like the bands to run in the cab, template the outline of the cab accordingly, and get cutting. You might prefer to classify slice 9 as a banded pattern type and you'd be justified in doing so.

Ditto for 3A, 3B, and 7. Frequently with Lake Superiors, as already pointed, several classifications are very often justified. And, in such cases it's purely a matter of personal choice, depending upon which pattern feature appeals most to the individual.

How would you classify the pattern in slice 10? Because of the various elements and their arrangement Lake Superiors like this one make classifying a difficult problem. Since there are actually two different distinct agate pat-



With a background of translucent light brown and white bands in 10 stand out.

terns, one at the top and the other on the right, I would classify this slice as a combination pattern. You'll run across quite a few Lake Superiors of this type. They offer very interesting and unusual lapidary opportunities, all of them individually different.

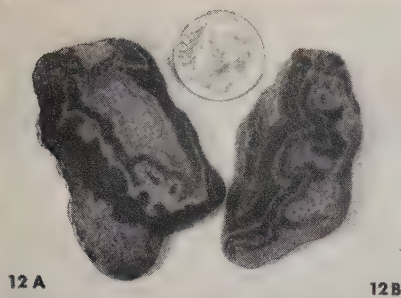
Another variety of the combination pattern type is illustrated by slice 11.



In cases like this I prefer to call them after the onyx pattern which form the base on the left hand side. Lake Superiors that fall into this type are very complex in design, as you can readily see. I like this type very much because there are usually so many different design choices available from which to plan a cabochon. If you make the right choice you'll have a cab with a most out of the ordinary appearance.

For really complicated pattern design I think you'll agree that slices 12A and 12B rank pretty near the top, if not right on top. So many different elements are involved in the over-all pattern. And, none of them dominate and thereby indicate a definite type. Another thing, very few Lake Superiors of this variety look anything alike which further adds to the difficulty of typing them.





*Tones of brown, tan, and red, neatly defined, predominate in 12A and 12B.*

\* \* \* \*

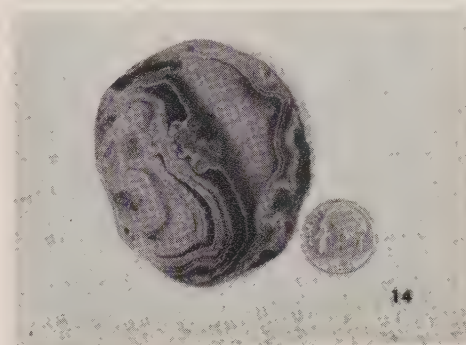
But whether they can be typed or not they are exotic, and so are the cabs cut from them. Photo J4 on Page 221, (June) shows a ring with a cab cut from a Lake Superior very similar to 12B. The matching pendant in Photo J5 at the bottom of Page 221 contains a large cab cut from the same Lake Superior, which was one of the finest we ever found in our hunting at Bellevue, Iowa.

The second outstanding major characteristic of Lake Superior Agates, which contributes so much to their appeal and desirability is—color. Again, in all probability, Lake Superiors are unsurpassed by any other cabochon gem material from at home or abroad for such superb, artistic, and versatile use of colors . . . and . . . the masterful manner in which they are combined with the various pattern elements. Here Mother Nature apparently exercised restraint, put on the brakes, and instead of going all out in the selection of colors confined herself to only four—red, brown, gray, and white. But, these are used in a multitude of assorted shades and tints, from light to dark. The end result is a seemingly unlimited variety of perfectly balanced exotic color combinations, some bold, others subtle, but all of them harmonious. As an after-thought, other colors must have been sprinkled in sparingly, here and there, because various shades of blue, yellow, purple, and orange appear on rare occasion in some of the Lake Superior Agate color combinations.

Appropriately enough slices 13A and 13B appear at this juncture in our series

and they will be used to serve a double purpose. First, they are both good examples of moss in Lake Superior Agate, a definite type that is anything but common. Slice 13A has an over-all moss pattern imbedded in a background of translucent agate. Slice 13B is a combination of moss with a full agate pattern. Second, these two slices exhibit unusual color usage in Lake Superior Agate. The moss in 13A is a deep red with a slight purple cast. In contrast, the moss in 13B is a deep purple with a slight red cast. The two inner bands in the agate pattern are white, while the two outer bands are orange in color, all of which makes 13B most unusual on several counts.

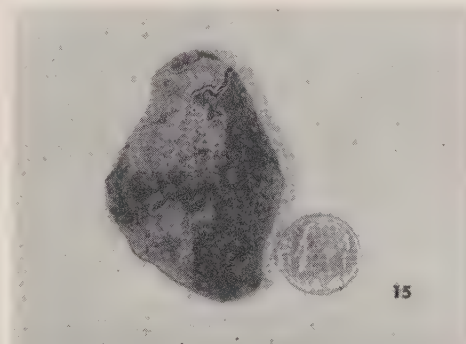
Relatively very few Lake Superior Agates include tubes in their pattern make-up such as illustrated in slice 14.



*Often gray is a drab, somber color but not in Lake Superiors like slice 14.*

\* \* \* \*

Usually when you are fortunate enough to come into possession of a Lake Superior of the tube type you can expect to find a pattern that is decidedly different, as this one is. The color combination here is all gray, very much as it appears in the photograph, except that a touch of light brown was added as if to give a bit of warmth to the ensemble. Wouldn't slice 14 make a large, striking oval cabochon for a sterling silver pendant?



*Pattern plus a wide variety of grays and whites make 15 very interesting.*

\* \* \* \*

Only once in a long, long time will you come across a Lake Superior with a clearly defined over-all tube pattern such as you see in slice 15. The pattern

design is made even more interesting by the addition of the banded formations at the top and along the left side. The color is generally gray with the banding in white for pleasant contrast. Another exquisite example of the tube type is shown in Photo J6 on page 221. The teardrop cab is a symphony in color—reds, browns, creams, and white. We found the Lake Superior from which it was cut in a gravel pit near Clinton, Iowa and have gone back several times looking for more but so far, no such luck.

Eye agates are a highly prized oddity in almost all types of gem material and particularly so in Lake Superior Agates where the occurrence is very infrequent. Usually in Lake Superiors the eyes are mainly only on the surface and it is generally prudent to polish the nodules as is, to preserve the shallow eyes. The nodule from which slice 16 was sawed

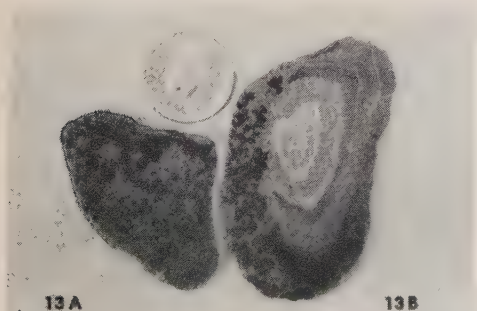


*Eyes—pretty blue, painful black, and the brown kind in 16, invite looking.*

\* \* \* \*

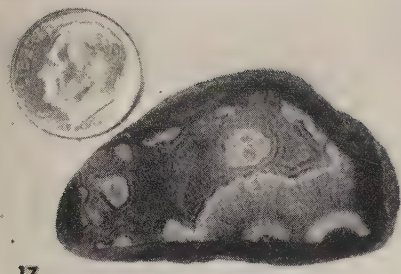
showed no trace of eyes on the exterior, and came as a complete but very welcome surprise. The larger eyes are an attractive rich medium brown ringed in white. If you will look closely you'll also see another lighter colored eye near the center of the slice. It is the same soft, very light brown color as the background and has a pupil a few shades darker. The fourth section of the bracelet in Photo J2 on Page 220 contains a cab with an eye that has been looking at the world since shortly after we found it in a gravel pile at LaGrange, Missouri.

Undoubtedly, the scarcest of all Lake Superior Agate types is that which contains sagenite somewhere in the pattern. Slice 17 is a very fine example. So rare is the occurrence of these hair-like inclusions that out of all the Lake Superiors I have cut and polished I have come across sagenite in less than a half dozen of them. My collection of 101 unusual Lake Superior Agate cabochons includes 2 cabs with sagenite which make very interesting additions. Slice 17 is beautifully colored with a combination of matching reds and whites. The border around the edges is dark red, the agate formations are two lighter shades of red, and the background is a



*Lake Superior Agate cabochons showing moss, as in 13A-13B are outstanding.*





Trued up, to make a half oval, then polished  
—imagine 17 in a pendant.

\* \* \* \*

matching red tint. White and light gray borders add nice contrast. The sagenite needles are reddish brown in a translucent field with a very slight reddish cast. We found the small nodule from which slice 17 was cut in a gravel pit on the west shore of Lake Pepin, on the Mississippi, only a few months ago.

For me its happy days are here again whenever I diamond-saw a Lake Superior nodule which yields two almost perfectly matching slices like the pair which are identified as 18. Such twins



How would you use butterfly wings like 18  
—bracelet, coat pin, pendant, or....?

\* \* \* \*

are commonly called butterfly wings. In Lake Superiors they are hard to come by because many of the stones you find are too small to produce two slices even fairly equal in size. Not only that but the nodules are usually rounded in shape with the pattern following the contour. In all, I'd say I've gotten only about two dozen pairs of butterfly wings from Lake Superior Agate, some of which have fantastic pattern and color combinations. I made a display out of four of my best, flitting around a white daisy cut from White Tube Agate which we found in Idaho. If you have the August, 1955 issue of the *Lapidary Journal* you can see what it looks like on the front cover.

The butterfly wings labeled 18 are a bright and lively combination of various shades of red ranging from ox blood to coral pink with contrasting white and light gray bands. The nodule from which they came was formerly a native of Muscatine. The color spread on

pages 48 and 49, includes a double pair of butterfly wings which is the most artistic and colorful combination I have. The top pair came from Bellevue, the bottom pair from a gravel pile near LaCrosse, Wisconsin.

Earlier in this chapter I pointed out that the wide popularity of Lake Superior Agates was most likely due to two outstanding major characteristics—pattern and color. I also mentioned that these two were augmented by a number of secondary factors, each of which contributes to the almost universal appeal and desirability of Lake Superiors. There are four of these contributing secondary factors: 1—compactness of pattern and color combination; 2—excellence of material; 3—hardness and durability; and, 4—lapidary qualities.

In examining the various slices shown, you have very likely already observed, that in *gem quality* Lake Superior Agate, regardless of size, the compact pattern and color combination is fully developed, precisely detailed, and perfectly proportioned in practically every instance. Even in the smallest nodules everything is usually there in diminutive form—each one a masterpiece of design in miniature. This condition exists in some other cabochon gem material, to be sure, but it is especially prevalent in Lake Superior Agate.

Consequently, from a lapidary standpoint, because of such compact concentration of so much in so little space, large size in itself is not necessarily a prime requisite in Lake Superior Agate. Those of larger dimensions are, of course, highly prized for obvious reasons. However, as a rule, those that range from ¼" to 1-½" in length will provide plenty of opportunity to meet most collection display and jewelry requirements. But, irrespective of measurement it certainly seems that these comparatively small size nodules were purposely created for eventual lapidary treatment.

To illustrate the latter point refer again to page 71 and look at Marge's ring in Photo J8. The cabochon measures only ¾ of an inch from top to bottom, yet it is anything but small when the ring is on her finger. The cab in my ring, in Photo J3, is ⅞ of an inch in length, which is also ample in size, as you can see. Incidentally, unless I mentioned it you might not even suspect that these two Lake Superior Agate cabochons are in any way related, because their attractive, colorful patterns are so completely different. But they are. And, in fact, both came from the same 1" Lake Superior nodule which we found on one of our early hunting trips to Bellevue. By the way, how do you like the pattern in the cab in Mrs. C's ring? We call it, "Waterfall In Lake Superior Agate".

And, while you're on page 61 closely examine the cabochon in the coat pin

shown in Photo J7. We think it is an outstanding example of the compactness of pattern and color combination that is especially prevalent in Lake Superior Agate. In this respect, it includes practically every desirable feature and appealing detail. Nothing seems to be lacking.

This particular variety of Lake Superior Agate ranks very high in our esteem mainly because of its sheer, overall elegance. To us it has exotic design, it has exquisite coloration, and the two are superbly combined. And, to add to its striking unusualness, this variety is uncommon to the n'th degree. In our opinion, it is representative of the finest in Lake Superior Agate gem quality. And, in this opinion we have lots of company. We'd drive back to LaGrange anytime just to get one more nodule that would give us another 1-¼ inch flawless cabochon with a plate glass finish like the one in the coat pin.

The next of the secondary factors is—excellence of material. For excellence of material itself, it is hard to beat the uniform, consistent high quality of gem grade Lake Superior Agate. To start with, the nodules are completely free of all matrix of any kind. This is a very important feature which is not shared by many other kinds of cabochon material in the rough state. In addition, Lake Superiors have no outer skin or rind of any significant consequence that must be cut away. And, pits, soft spots, and fissures are the exception, not the rule.

But, no rough, field run material exists that is without a high proportion of imperfections of one kind or another. And, these imperfections sharply reduce the gem grade contents of the rough to a small fraction of the total volume. Lake Superiors are no exception. They are all agate, true enough. However, they are not all of *gem quality*, by any stretch of the imagination. Relatively few merit such distinction. In the final analysis, the percentage with real gem quality is actually pretty slim.

What are the defects that are normally encountered in Lake Superior Agates? They are some of the same familiar ones that are so common to so much other rough material. For example, some Lake Superiors are off color—either too light or too dark. Some have insufficient pattern—or no pattern whatever. Others have large areas that are filled with white quartz, commonly called sugar, some of which will polish, some which will not. But fractures ruin more Lake Superiors than all other defects combined. Very few Lake Superior Agates are entirely free of them. And, to top it all, these defects are frequently not evident on the surface. Many of them seem to keep well hidden until you start cutting.

From our own experience we have become stoically adjusted to the realiza-



tion that roughly 50 out of each 100 field run Lake Superiors we lug home from a hunting trip will eventually turn out to be duds, for one reason or another. We know, too, that when the cutting starts, approximately 25 more will fall by the wayside. This usually leaves about 25 on which we can pin our hopes. By the time the preliminary grinding or diamond sawing has been completed, another 15 or so will have become casualties.

In the end, we think we are fortunate if 5 to 10 nodules have yielded gem grade cabochon material. And, more often than not, only 3 or 4 will have yielded material which we would rate high to top quality. We've compared notes with many other rockhounds who have worked with Lake Superiors. It appears that our experiences have been quite similar. Most of them philosophically shrug off the high nodule morality rate and grin with pride as they say: "But you should see the swell cabs I *did* get from the nodules that were left." We feel the same way.

The third of the secondary factors—hardness and durability—practically explains itself. As a member of the famous quartz family of minerals, Lake Superior Agates have a hardness rating of 7 on Mohs hardness scale. And, make no mistake about it—Lake Superiors are really hard. In fact, I suspect that many of them are considerably harder than the broad rating of 7 implies, judging by the manner in which some of them persist in withstanding the sharp cutting action of a silicon carbide grinding wheel. Because of their hardness, Lake Superior Agate cabochons are very durable. With only reasonable treatment they'll withstand a surprising amount of hard wear and endure for years.

The hardness found in most individual Lake Superior nodules is uniform and consistent, with only two possible exceptions. The first exception relates to those Lake Superiors where white quartz or sugar filling exists. Sometimes, but not always, the white filling tends to be less hard than the surrounding colored material. Examination with an ordinary hand magnifying glass, will quickly reveal the nature of its construction. If it is relatively loosely held together and there is evidence of small pits here and there you would be wise to avoid using it as part of a cabochon. It will usually be difficult to polish without excessive undercutting and pit filling. However, if the white filling is smooth, solid, and compact it will generally polish with little or no difficulty. I've polished many cabs with areas of sugar filling and instead of detracting it actually added to the attractiveness of the finished gems.

Only on very infrequent occasions have I encountered the second possible exception to uniform and consistent

hardness. Every once in a long, long while I've come across a piece of Lake Superior Agate that showed a tendency to undercut slightly on the alternate lines in the banding. This is apparently due to a variation in the hardness of the material in the bands. The lighter colored bands, particularly if they are translucent or nearly so, seem to be a trifle less hard than the darker more opaque bands, with the result that they tend to under cut a little bit. The result is—the finished cab has an almost imperceptible washboard effect across the polished surface. But almost imperceptible or not—the ripples are there. In such cases I go back to the 600 grit sanding wheel, remove the ripples, and repolish on my leather wheel, using cerium oxide as the polishing agent. It works, 9 times out of 10.

By now, the lapidary qualities of Lake Superior Agates, the fourth of the secondary factors, should be so well understood, that very little additional comment seems to be necessary. In essence, gem quality Lake Superiors have so many lapidary virtues and so very few lapidary vices, so to speak, that they are just about as fine a gem material as you can get, regardless of origin. In fact, if you can do a good job with Montana Agate, Arizona Petrified Wood, and similar highly agatized gem material—you should be able to do a comparably good job cutting and polishing Lake Superior Agate, simply by using the same identical lapidary procedure you usually use.

To help you in applying your particular lapidary procedure to Lake Superiors, these two suggestions are offered for what they may be worth. While Lake Superiors have a hardness of 7—don't get the idea that you can treat them in a rough manner. They simply will not stand for any kind of manhandling. Use smooth, well-trued grinding wheels—and don't jam the cab into the wheels, with all your weight behind it. Instead, use an even, medium pressure—and take your time.

All along the line, be certain that you do not allow Lake Superiors to get warm, never hot—especially in the sanding and polishing stages. If you do let them heat up you may be surprised to suddenly find a fracture in your cab—where there wasn't a fracture before.

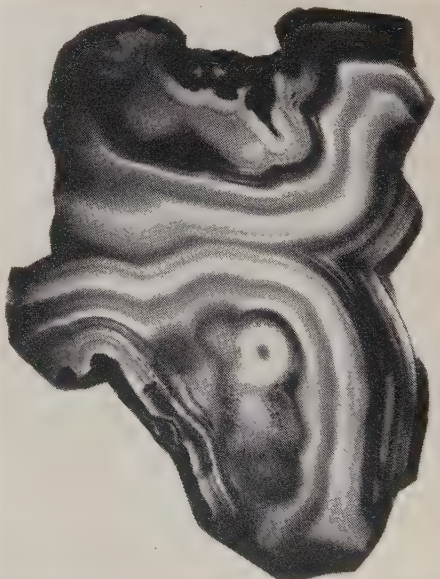
Now, all you need are some rough Lake Superiors so you can try your hand at cutting and polishing them. One way to get them is to visit one or several spots in the happy hunting grounds and find them yourself. That's what we do. It doesn't make any difference where you live—you'll enjoy the trip . . . and . . . the scenery all along the Mississippi is refreshingly beautiful. Where should you go? That's really immaterial. We've found Lake Superiors at all the places I've mentioned. And, since there are

commercial operations in all the spots, bringing fresh, new gem bearing gravel up to the surface regularly, the supply of Lake Superiors is not depleted but as good as ever. How do you find the dig-gins? Just ask any gas station attendant how to get to the local gravel company office. You won't be the first one who has asked him the same question. And, when you get to the commercial operation—don't neglect to ask for permission to do a little agate hunting on *their* private property. We've never been turned down.

Before you start stowing your gear into the crowded rear deck of your car, let me suggest ways and means of providing more space. Leave the gunny sacks and bushel baskets at home. The same with the shovels, picks, and points. Just come as you are. Your pants pockets will hold all the Lake Superiors you'll probably find. Mine generally do. If you're extra lucky and the pockets over flow, do what I do—empty the pockets into a small field bag and then go back for more. Will you find some? The chances are you will if you keep at it. We've never come home empty handed.

But don't feel underprivileged if you can't visit the hunting grounds. You can still do your hunting through the ads in *The Lapidary Journal* and the 1961 *Rockhound Buyers Guide*—and let Uncle Sam deliver your Lake Superiors right to your front door. This alternative suggestion may not provide you with the thrills and excitement of finding your own but it does have one compensating advantage—it will be a lot easier on your budget.

And I'll bet that after you've cut and polished only a few, you'll agree that: for pattern and color, Lake Superior Agates certainly *are* in a class by themselves.



*Walter Kohn's Brazilian agate with bird. Banded agate with swirls and eyes lends itself to the formation of "pictures"—how many is limited only by the perception and imagination of the viewer.*



# The Colorful Agates of NORTHERN MEXICO

By Wm. J. Lyons and Jack R. Young  
El Paso, Texas

A look at the map of Mexico, which accompanies this article, shows the fairly new Highway 45 in the State of Chihuahua, heading due south from El Paso, Texas. After the traveler gets a short distance south across the rather dry looking country, you will begin to pass through a country that is cut by valleys and uplands, gradually rising toward the Sierra Madre sub-ranges. On the traveler's right hand side going south are the Sierra del Nido and Sierra del Arco mountains to the west. On the left side, to the east are the Sierra de la Tasajera mountains.

Throughout the 232 miles distance that lies between El Paso and Chihuahua there are possibilities for finding agates along the route, but not directly on the road. The entire country is taken up with very large ranches which are private property and the owners know the value of the agate deposits existing on them.

The country is generally of a volcanic type, with vast areas where agate has

been formed by filling of vesicular cavities in the ancient lavas, rhyolites and tufas. In the early days, when rock-hounding had not yet reached the stage where there is a steady and ready market for all the fine grade Mexican nodular agate that can be produced, there might have been a chance that the individual rockhound making this trip could have come upon areas where nodules could be picked up in the rolling plateau country.

Today the conditions are quite different. A good road has now been built connecting Chihuahua and points south with El Paso. The rockhound hobby has grown, so that now the ranch owners and their "hands" who live on the ranches know that the gathering or digging of agate nodules will yield ready money in good U. S. dollars, which when converted at the going rate of exchange for pesos, means a lot of spending money among a people who do not always have much of that.

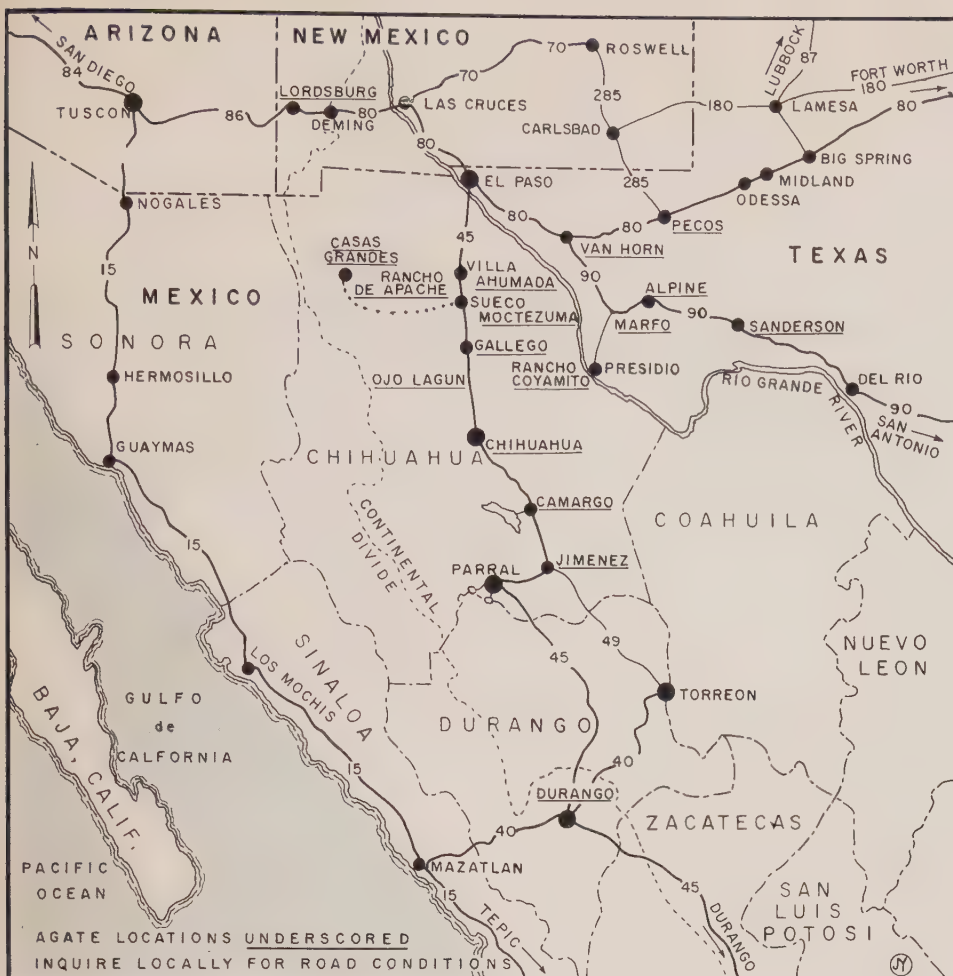
The result is that every agate nodule which shows itself is eagerly picked up and gathered into a lot to sell. There is no such thing as "free hunting" for the average amateur rockhound. Local entrepreneurs or brokers gather up the lots of agate from various localities and ranches and these are either brought to El Paso or other border points and offered for sale, or picked up by the trucks of dealers who have previously made contracts with the brokers to take all they produce.

Ranch owners take a very dim view of the amateur "do-it-yourself" rockhound who is seeking agate. Questions for "piedras" get a shake of the head . . . "quien sabe?" . . . who knows. They may have an agate bed on their far-flung ranch, but they can be and are very cagey about giving out information.

Hence the agate game in Northern Mexico very largely follows the pattern of finder to broker to dealer, who then offers it for sale after further grading.







### Types of agate

Some of the finest agate known is found in the mountainous areas of Northern Mexico, in the state of Chihuahua. Many of these areas are not accessible to the rockhound, as they are off the main highway and in rough country where the average automobile will not be able to go. The agates in these areas are of both nodular and vein formation and vary a great deal in respect to color, fortification, and general appearance.

Names applied to Mexican nodular agates generally have a direct connection with the locality that produces the agate. Each type of Mexican nodular agate has its own personality and characteristics. In the nodular type agate, the percentage of nodules free or somewhat free of defects will vary from one load of agate to the next, even though it is the same type. The causes for this variation are not actually known.

### Laguna agate

This type is probably the most consistent and widely known of the Mexican nodular agates. The colors run from a deep blood red, lighter reds, to some purple and lavender shades, sometimes with a blend of yellow and pink. The fortifications in this agate are very good, generally being in a rather fine pattern line but still very distinct.

### Moctezuma agate

Colors in this agate tend to lean generally to the pastel shades of yellow, tan,

some pink, variations of blue, an occasional band of green tinge, but rarely the deep reds of the Laguna type. Frequently we have found patterns that show single and double navel entries which flare out into the full fortification of the entire piece. The fortifications vary from fine lined to a somewhat heavier line and may have both in the same piece. This is a particularly good agate for obtaining matched pair slabs. We have in many cases found as many as four almost perfectly matched slabs in one nodule.

### Casas Grandes agate

The colors here range from a good gray color through a lavender shade, to a purple. An occasional pink or reddish tinge to the lavender is sometimes found. The fortifications in this agate are very good and compare favorably with the best of the nodular agates.

### Coyamito agate

Colors in this type run from light reds, some yellows, some pink, variations and an occasional purple pattern. Frequently this agate reveals excellent tube formations which, when cut across the tubes, form eye patterns of various colors. Also found in this agate are some pseudomorph formations, some of which are exquisite in design and color. Most of these pseudomorphs are after aragonite. This agate runs to a rather high percentage of cavities, but in many cases where the cavity is encountered, so are the tube and pseudomorph formations,

which in the opinion of many, make it a more attractive and valuable piece than if it were solid. The small to medium size nodules are by far the most consistent for good cuts, but the larger pieces, although less consistent and more apt to run to crystal centers, tend to be the pieces that have more of the tube and pseudomorph formations.

### Apache agate

This agate, in our opinion, is one of the most beautiful in colors and patterns. Colors in this agate are exquisite, being a combination of bright red and vivid orange surrounded by a light to dark blue. These colors blend into a folded cloak formation rather than the common fortification pattern found in other nodule agates. This agate, above all others, has its own personality. Tremendous color combinations and patterns are often found in a nodule that has a cavity showing on the surface. This is a fairly consistent characteristic of this agate. This agate will produce more suspended center patterns than any other with which we are familiar. The smaller nodules are the most consistent, but a large piece of Apache generally with a cavity showing on the surface, can cut to an unsurpassed thing of beauty.

### Eye agate

This is also a type of nodular agate, but is not suitable for cutting. This agate is found in very small pieces ( $\frac{1}{4}$  in.) up to pieces as large as 1 in. to  $1\frac{1}{2}$  in. The majority run from  $\frac{3}{8}$  in. to  $\frac{3}{4}$  in. It has a very thin outer skin, which when tumbled, reveals exquisite small eye patterns of various shades and colors. These eye formations are generally as perfect as if they were drawn by a compass and may be very tiny to as large as  $\frac{1}{4}$  in.

### Lace agate

This agate, many times called "Crazy lace" agate, is probably one of the best known agates coming from Mexico. It is generally considered to be a vein type agate, but we have seen many pieces of it that are actually in nodular formation. Its name is derived from the pattern which the agate itself reveals, being a lacy elongated pattern and ranging in colors from light gray and white to some reds and pinks. This agate is found in several different localities in Chihuahua.

### Opposite Page . . .

First row top, read across:

Laguna agate from Ojo Laguna, Chihuahua, Mex. This piece shows varying eye formations in addition to normal fortification lines.  
Moctezuma agate from Moctezuma, Chihuahua, Mex. Coyamito agate from Rancho Coyamito, Chihuahua, Mex. This piece shows both the fortifications and the aragonite pseudomorph formations.

Second row, left to right:

Circular slab — Moctezuma agate from Moctezuma, Chihuahua, Mex. This piece shows suspended center of agate inside drusy quartz—rare.  
Small aark slab — Apache agate from Rancho De Apache, Chihuahua, Mex.  
Center—Free form silver pendant with natural map of South America. Collection of Mrs. Hugh Leiper.  
Right — Purple amethyst lace agate from Durango, Ugo., Mexico.

Third row:

Pair matched slabs of Laguna purple agate. Pair Casas Grandes matched slabs, Chihuahua, Mexico.  
Right—A large slice of Apache agate showing the vivid red veils similar to the Hooded Owl on our cover. Rancho De Apache, Chihuahua, Mexico.

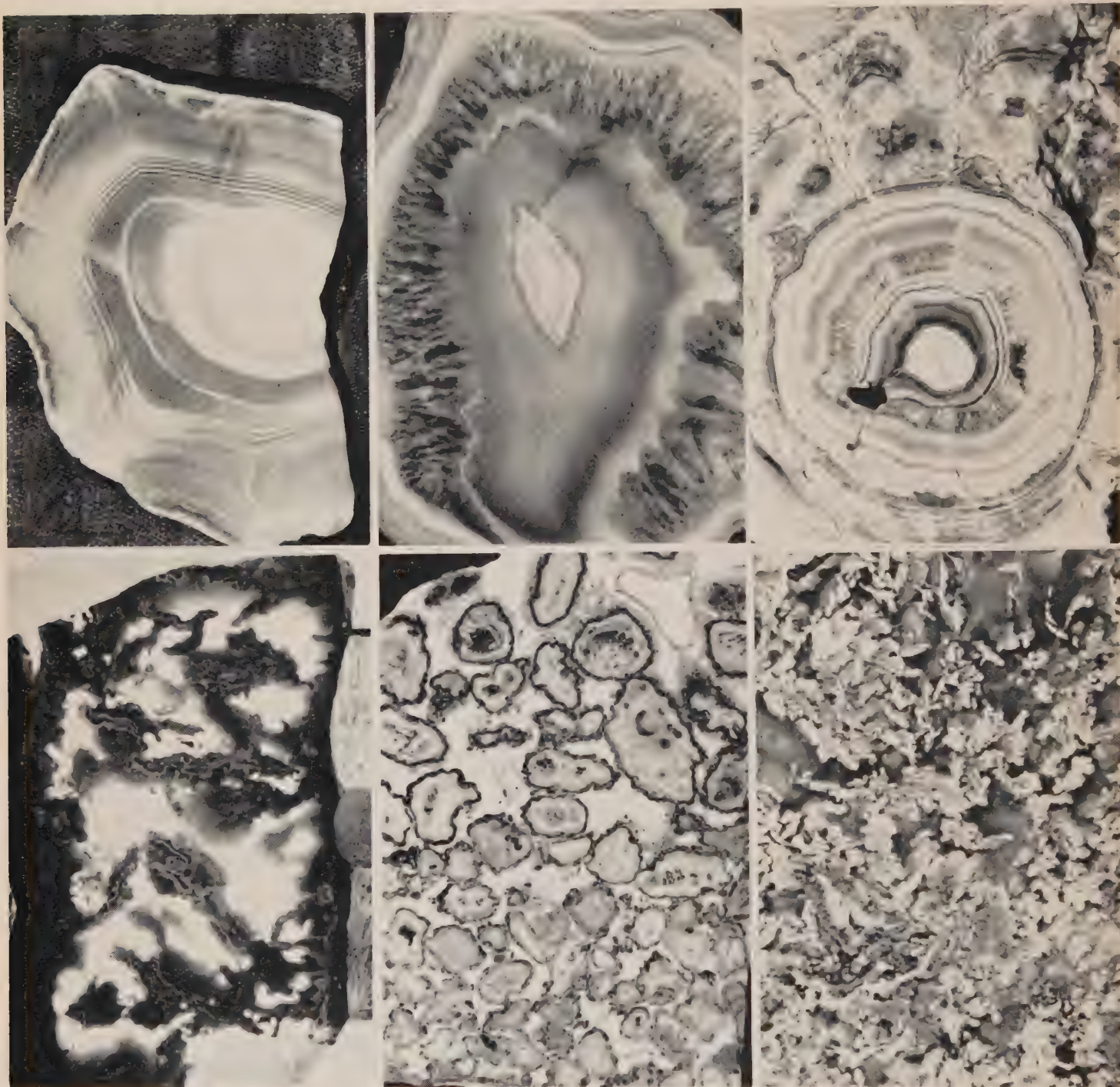
Bottom:

A prize winning bracelet made from various types of Mexican agate. Collection of Mrs. Hugh Leiper. (All agate slabs courtesy of Wm. Lyons of Lyko Mineral & Gem, Inc., El Paso, Texas.)



# NOVA SCOTIA AGATES

*—The Seeker Can Find Charm . . . .*



## NOVA SCOTIA OFFERS VARIETY AND BEAUTY IN AGATE

1. White and gray banded agate, Scot Bay, N.S.
2. White and gray banded agate with band of quartz crystals.
3. White, gray and beige banded agate filling cavity left by a rotted plant stem. The agate is surrounded by a wide zone of mottled chalcedony replacing limestone. Bennet Bay, N. S.
4. Very beautiful plume agate vein. Plumes are bright red on the outside and a brilliant yellow inside. They are set in clear, locally banded, blue-gray chalcedony. (Locality undisclosed.)
5. A novelty—light green to rich blue-green irregular ovoids, spotted and bordered with dark red or brown, and set in gray chalcedony or white cachalong. (Locality undisclosed.)
6. Mixed red and yellow moss-like in form, intergrowths in clear blue-gray chalcedony. Minas Basin, N.S.

PHOTOGRAPHS FROM WM. F. TAKE



# ... as well as Agates

By Wm. F. Take

Curator, Nova Scotia  
Museum of Science  
Halifax, Nova Scotia, Canada.

Agates in Nova Scotia occur in some variety, in varying abundance over a wide area. Many of the typical varieties of agate occur, as well as some which may prove to be generally rare or unique. At all events, they are proving to be more abundant, more colorful and more widespread in their occurrence than was formerly believed.

If we accept as a rough definition that agate is a term generally applied to chalcedony or chalcedonic silica having some definite pattern, which when pure is white to gray in color, but may be highly colored or tinted by various natural mineral pigments or fine grained mineral inclusions; we may then classify the agates which occur in Nova Scotia primarily according to pattern, and secondarily according to color, as follows:

- (1) Banded patterns
- (2) Moss patterns
- (3) Plume patterns
- (4) Breccia patterns
- (5) Spotted or blotched patterns
- (6) Replacement or pseudomorphic patterns

**Banded agate** occurs as common banded or "topographic" agate, eye agate, fortification agate and true agate-onyx in roughly that order of abundance. The commonest type an inter-banded mixture of gray transparent chalcedony and white, nearly opaque chalcedony, in bandings of weak to medium contrast. The contrast however, can be very marked, and at a few localities, the colors can be quite intense, varying from yellow to yellow-ochre, brown of several shades, reddish-brown, gray and white. Rarer specimens show scarlet, magenta, mauve and orange as well.

**Moss patterned agate** occurs in abundance over a wide area. The matrix of this agate consists of either clear gray chalcedony or a nearly opaque white variety. The former is known locally as true "moss agate" and the latter as "porcelain moss agate."

The many intergrowths within the chalcedony vary greatly in color. The true "green mosses" occur in several shades, but mossy intergrowths of bright red, reddish-brown yellow and yellow-brown are much more common. Mixed inter-growths of yellow and red are very common. Rare specimens show black "moss" or green "moss" frosted and tipped with pink, white or cream.



From here at Grand Pre, Nova Scotia, the Acadians were expelled by the English in 1755. Today it is the site of Grand Pre Park. In the background is North Mountain and Cape Blomidon. The ridge is capped by Triassic basaltic lavas in which the agates and zeolites of Nova Scotia are found. On the far side of the ridge, the lavas come down to the Bay of Fundy shore, where severe marine erosion caused by fifty-foot tides, waves, currents, and winter ice, maintains a fresh supply of agate at good localities. Amethyst Cove is about three or four miles behind the Cape in this view, while Scot Bay, the best agate locality in Nova Scotia, is over the ridge at left.

NOVIA SCOTIA INFORMATION SERVICE PHOTO

**Plume patterned agates** are gradational to the above and very similar in most respects. The prime difference between "moss" and "plume" patterns, as locally applied, being one of coarseness of the pattern together with a concentration of the mossy constituents into "plumes" or feather aggregates in the chalcedony.

**Breccia patterned agate** is not uncommon, and usually consists of fragments of colored chalcedony or jasper cemented together by clear chalcedony. The colors of the fragments vary from light yellow to yellow-ochre, brown, reddish-brown and red. Rare specimens have fragments of green plasma. One exceptional specimen shows orange specks and dots in light green plasma fragments.

**Dotted and blotch patterns** of delicate shaded to indifferent color and contrast are very common, and occasionally specimens of striking beauty are encountered. Perhaps the rare, highly colored intergrowths of red and yellow jasper with green plasma and bloodstone should be mentioned here. Among spotted patterns, bloodstone occurs infrequently, and rarer types include black

spots in clear chalcedony, and the orange spotted plasma previously mentioned.

**Crystal replacement or pseudomorphic patterns** are common. These have formed from the replacement of crystals of zeolitic minerals by chalcedony. The commonest type shows a pseudomorphic network of tabular crystals whose pattern on a polished surface looks like that of a log jam in a river. Color usually ranges from a cream to a pale bluish-gray in this type.

Nova Scotian agates are found primarily in the lava cliffs and on the beaches of the Bay of Fundy. The localities are scattered from the central Minas Basin area all the way to the Briar Island off Digby Neck, a distance of over 140 miles. The best known and most productive localities are at Cape Blomidon (Amethyst Cove), Scot Bay, and along the shores of Digby Neck. Occasionally fine specimens turn up in the glacial drift in the large Southwestern area of the province between Halifax and Windsor to the East, and Yarmouth to the West, but these are thinly scattered and are lucky or chance finds at best.



# ROCKHOUNDING IN THE PRINCE GEORGE AREA

## —British Columbia

By Art Bell

My sincere appreciation goes to a North Vancouver rockhound, Mr. Wayne Boyd, who, while a resident of Prince George a few years ago sparked my interest in the hobby and assisted me in many ways to get started as an amateur lapidary. Wayne is a real craftsman and a lapidary equipment inventor of considerable skill.

Situated in the geographical center of British Columbia at the junction of the Fraser and Nechako rivers, the City of Prince George is also near the center of the extensive beds of tertiary age lava flows that practically cover the interior plateau of our province. It is in the lavas that most of the agate has been formed.

The Nechako river from its source to its junction with the Fraser cuts through many tertiary lava flows containing varieties of agate and jasper, scattering nodules and pieces amongst the gravel all along its length. The Delta that the Nechako river built up as it entered the Fraser ages ago is now the site of the city of Prince George, agate and jasper is found along all of the unpaved streets of the city.

A source of much of this gravel was a pit at one time on the outskirts of the city. Now housing has been built up all around it and every new excavation for a home strikes agate-bearing gravel, in most cases a few inches below the surface. Most of the agate is run-of-the-mill, however many pieces have proven to be of good quality, moss, turtleback, iris, dendritic, fortification, pipe or tube, ruin and sagenite, with colors varying, light honey-brown, clear, milky, black and some shades of red.

Jasper and jasper agate is even more abundant in this gravel with sizes running up to ten pounds. Some petrified wood and Tortilla agate has also been found. The Nechako river comes into Prince George from the west and has cut through many gravel banks all containing agate and jasper in varying amounts. Two of the most notable and accessible locations are described below.

**MIWORTH GRAVEL PIT.** Approximately eight miles west of Prince George on the south side of the Nechako river. This is a huge gravel pit about half a mile long and the property of the Canadian National Railway. This has been used by the railway as a source of ballast for forty years or more. Thousands of yards of gravel has been removed and carried as far as two hun-

dred miles east and west of Prince George, so a walk along practically any of the C.N.R. track within this mileage of Prince George will produce agate and jasper in worthwhile amounts. And possibly a quick departure from this world if you are engrossed in a find and a train coming around a corner catches you.

**BIG SLIDE.** Approximately seven miles west of Prince George on the north side of the Nechako river. This spot is aptly named because most of the time that is as far as one can go by road. At this spot the river and the road are along side of one another and the gravel slide often cuts off the road. This slide produces the same material as the Miworth pit.

People in this area are accustomed to long distances and think nothing of driving one hundred miles (one way) on a Sunday to a favorite fishing, boating or rockhounding spot, so we class such towns as Quesnel, Vanderhoof and Fort St. James as in our area and accessible for a day's outing.

Travelling south of Prince George on Highway 97 are many spots of interest to the rockhound. With agate and jasper the principal finds. The most accessible and fertile spots are, HIXON CREEK, approximately twenty-seven miles south of Prince George, AHBAU CREEK, approximately fifty miles south of Prince George, COTTONWOOD RIVER, approximately fifty-three miles south of Prince George.

A recent visit to rockhound Haide Karaki of the Mule Train Auto Court in Quesnel proved profitable when he showed me a fist sized nodule of jet black agate which he had dug out of a bank within five miles of Quesnel, he also had a three by four inch nodule from the same area that was colored a light honey-brown with black bands alternating through it. The exact location he did not disclose, but promised to take me there.

Out of the town of Vanderhoof in several directions are locations where agate can be found. Most notably the road to the Kenney dam, there are several locations on this road where the agate is in place, and also in streams that the road crosses. North of Vanderhoof forty-two miles is the town of Fort St. James, on Stuart Lake, the best known spot for rockhounding is along the beach of Sowchea Bay. (mostly agate.)

The Fraser Lake area is one hundred

miles west of Prince George on Highway 16. From my own quick visits, reports of prospectors and residents, it could develop into a rockhound's dream come true, because of the number of places where agate has been found in place.

The area one hundred miles in any direction of Prince George has scarcely been touched by rockhounds and there are hundreds of places waiting for discovery and development. It is truly one of the last frontiers for the North American Rockhound.

## *The Omineca Agate Story*

By Art Bell

In my early experience as a rockhound I had daydreamed several times about finding a deposit of real high grade material, possibly the best or one of the best of its kind, never really thinking it would materialize, until one day in the late fall of 1956. I was on a combination grouse and rock hunting trip in the Francois Lake area of North Central British Columbia.

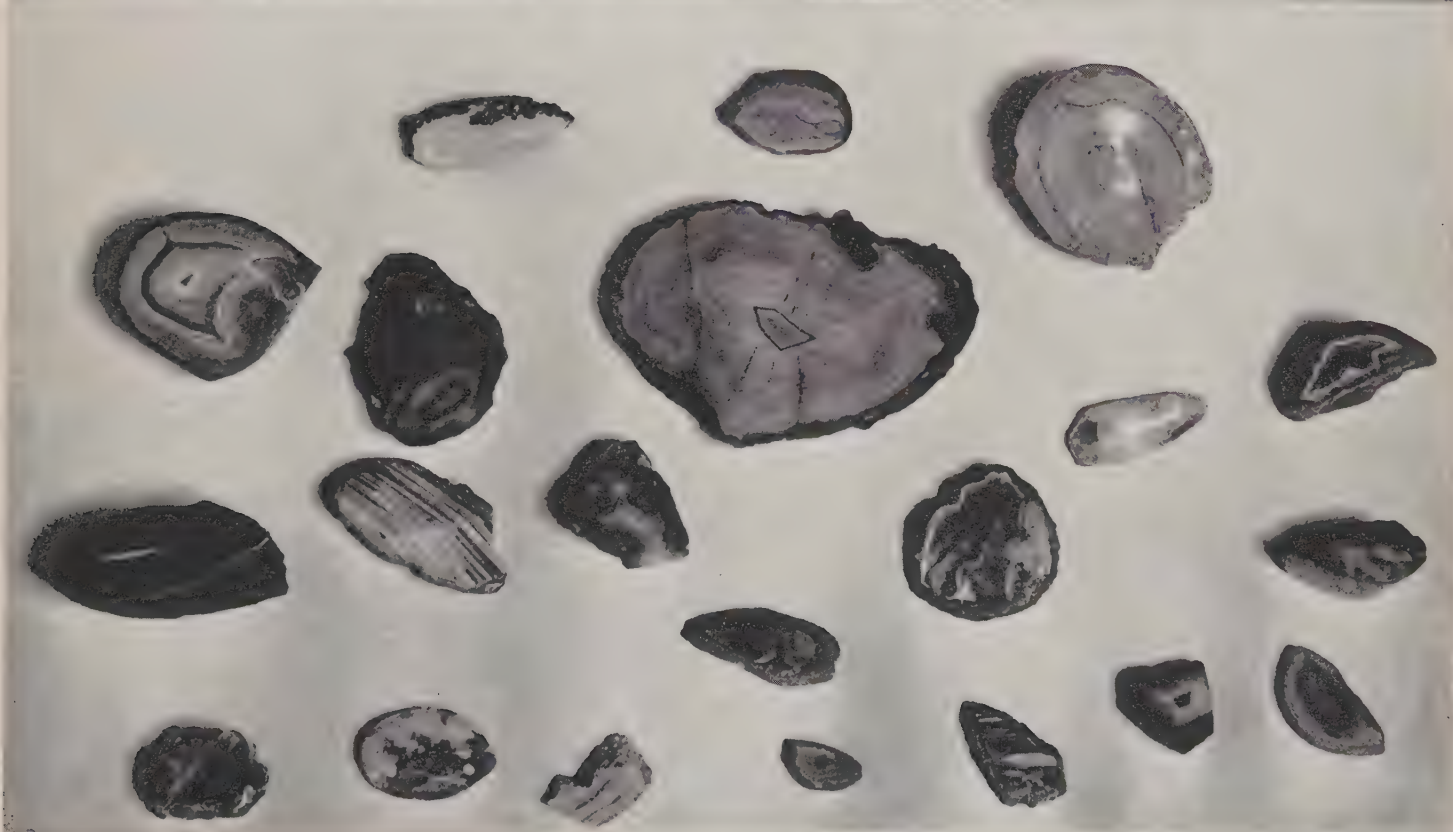
My two boys ages eight and ten and I had packed our rock bags with lunches and left Prince George early one Sunday morning to hunt and explore the north side of Francois Lake, I had been told that a primitive road in doubtful condition ran west of Nithi lodge, up the north side of the lake. We were about one mile along this road when we met two hunters coming from the other way, so I enquired as to how far we could travel and was told we could drive about seven miles further and the road would be quite good. Their information was correct in both regards and we found the majority of the road was very close to the lake shore, so we stopped at all likely looking beaches and scoured them for agate and other material.

Finally about seven miles up we had to leave the car and proceed on foot.

At the next beach one of the boys picked up a beautiful piece of a pink to scarlet banded agate. We were elated with the find and continued up the lake shore, progress was slow as two young boys can find so many things to poke into amongst the debris along the beach.

I felt sure there must be more of this fine material along the shore. As we were travelling westward and most of the storms on the lake have come out of the west. It would appear that the piece of agate we had found could have





The finished pieces in the top left corner are a deep wine color. The matched pair also have white centers. In the bottom row of these finished pieces are all shades of blue-gray, pinks, and pale lilac colors. The two pieces on the right center of the photo have a crystal center with an orange band and clear outer edge. On the top right is a clear pale pink with the center of the stone having white inclusions. The ring is a blue-gray with a bright red point centering

it. The cuff links and pendant are white shadow agate (look like "Lake Superior" agates). The large pendant is again the blue-gray type on a pink background. This only gives a small inkling to the unlimited designs and displays of color in the agate from this area of British Columbia.

In the panel of rough specimens of agate in the lower half of the page are: (center row, left edge) a deep raspberry colored agate with white center. Next

to this, the agate is bright orange with white bands . . . both are mentioned in the article accompanying. The top right corner is a yellow agate with a red flame, and below this is a "fish-head" agate. The large center agate is a slice 4" x 3" with colors of blue gray to pink, with a bright red band in the center.

Photographs by W. D. West Studios  
Prince George, B.C.



travelled frozen in a piece of ice from further up the lake. We found several small broken chips on other beaches as we continued. The afternoon wore on and darkness was not too far away, we were about to turn back, when I decided to try the bay on the other side of the next point. The lake was very calm and upon reaching the small bay that was beyond the point we were overjoyed to see the red, pink, scarlet and every hue of basic red sparkling amongst the gravel of the beach which was about fifty yards long. We rushed around the shallows paying no heed to the water running over the tops of our boots, picking up chips, pieces and nodules of this beautiful agate. Most of the pieces were half to an inch long in size, however, some of them ran up to three and four inches. The lake level was low and the gravel up on the beach fairly fine, we raked through this with our fingers picking out a considerable amount of small agate pieces suitable for cabs and tumbling.

Before we realized, it was getting quite dark and we had approximately a three mile hike back to the car, with no more time for further prospecting.

We arrived back home in Prince George late that Sunday night, and the first job was to carry into the house, two boys, sound asleep and dog-tired from the long day. While the boys were being put to bed I dumped our collection of agate into a large gold miners pan and viewed it in the water with a bright desk lamp. It was then that the full impact of the beauty of the material hit us. We were amazed at the color variety and shades of pink, red, crimson and the contrasting bandings and patterns. We knew then that this material was unique.

I was determined to go back to the area at the earliest possible moment, however fate in the form of old man winter moved in before the following weekend and winter set in in earnest with snow and freezing weather. I was stuck with the situation, knowing I would have to wait until next spring to get back into the area.

All winter long the thought was with me that the agate had to be in place close by the beach where we had found it. Most of the pieces were quite water worn, however some had chunks of the basalt matrix stuck to them, so I knew it had not come far. That winter I sent a few pieces to Dr. H. C. Dake of Portland, he described it as being of the best quality and equal to Mexican varieties.

The first good day the following spring we again packed our kits and headed west at the break of dawn. Upon reaching the lake we learned the ice had gone off the lake during a storm earlier in the week, we then hired a boat and outboard motor from the Nithi Lodge and proceeded up the lake. When we reached the small bay where we had found the agate, the gravel was once

again dotted with pieces of the same beautiful material. The ice and storms had churned up the gravel exposing more of the agate.

This time I left the boys exploring the beach and headed with hammer and pick in hand to the nearby small bluffs in the center and other side of the bay. The answer is of course obvious, the first glance revealed nodules and pieces sticking out of the basalt in numerous places over a hundred yard area.

The first big disappointment of the find was when I discovered how hard the basalt matrix was, and how difficult it was to get the nodules out without shattering them. The second disappointment was to find that upon sawing the nodules, a large percentage of them are fractured. I believe from frost action. However, every so often a nodule comes out intact and upon sawing will be found fracture free.

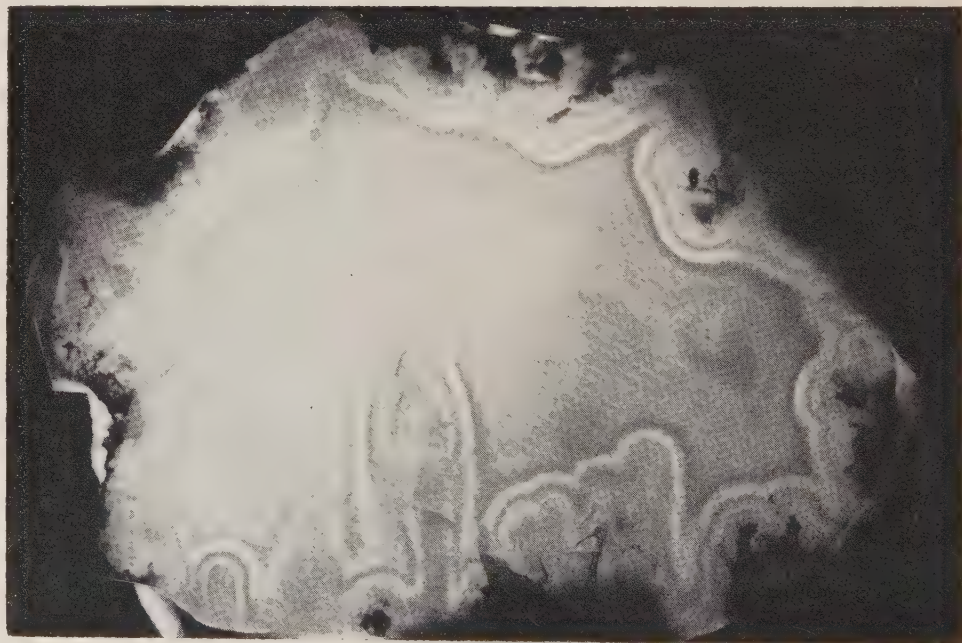
One nodule in particular measuring approximately one and a half inches wide, and four inches long turned out to be a pleasing deep raspberry red color and fracture free, slices of this piece are very highly prized by the rockhounds that I presented them to. Another piece picked up in the water was colored clear, white and orange in alternate flat bands.

The largest nodule dug from the basalt measured three inches thick by six inches wide and ten inches long, unfortunately this piece was given a direct blow with a sledge hammer while being removed from the matrix, a later inspection proved it would have been fracture free, had it not suffered the hammer blow.

I have since made many trips into this deposit and removed a fair quantity of material. A full days work will produce about fifteen pounds of agate of which ten to twenty percent is excellent gem grade, the balance grading from good to worthless.

All the beaches and basalt outcrops adjacent to the lake and in the area of this deposit I have prospected and in doing so found four more basalt flows containing agate, all within two miles of the original find. One flow in particular produced agate geodes up to ten inches round, containing quartz crystals some amethyst tinted. The material is of such fine quality that I felt it deserved a name of its own, hence the "Omineca" after the general area it was found in.

My own collection of this material grows larger every summer and anyone interested in seeing the collection will be welcome at any time.



*Madonna In Agate*

The slice of Mexican agate pictured above belongs to Harmon Blethen of 410 Fairmount Ave., Oakland, Calif. It is translucent white and golden color. The agate has caused wide comment because of the Madonna which is plainly seen although photographic reproduction of scenes in agates is always disappointing.

Blethen purchased the agate from the late Fred G. Brandt who had received it in a lot of agate slabs from Mueller's in Phoenix, Arizona. The slab was in a run-of-the-mill assortment and the picture was not noticed by anyone.

The slice belongs to Blethen's mother who has had it mounted in a shadow box with a picture frame front and gray velvet masking everything but the transparency. A 15 watt bulb provides good illumination. The slab was first publicly exhibited at a show of the *Santa Clara Gem & Mineral Society* in San Jose, Calif. where it caused wide attention and was reportedly visited by a group of twelve priests from San Francisco. "The slab is Mother's," writes Blethen, "but she does not indulge in the nonsense of locking it up in any safety deposit box. Who'd steal a Madonna?"



# COLLECTING IN COLORFUL COLORADO

## *By Byron H. Rohde*

Shipley's Mineral House, Gem Village, Bayfield, Colo.

The accelerated road building program these last few years has opened up vast new areas in Colorado to the visitor. Areas that one time required a jeep or pickup to prospect can now be visited with the average automobile.

Colorado, with its vast areas of public domain, is being visited by more and more collectors each year. Not only does Colorado offer a large variety to the collector, but a cool delightful vacation. Among its many assets, the state contains many national and state parks, from the dwelling places of ancient man, to sand dunes, to lofty snow-capped mountain peaks.

Although this article is intended for the rockhound gem cutter and collector, the foregoing only emphasizes the fact that many other pleasures await the visitor, as well as an enjoyable and successful rock hunting trip. This article is not intended as a gem trail guide. Two fine guides have been prepared for that purpose. Richard M. Pearl, Associate Professor of Geology at Colorado College, has written a fine gem trail and mineral guide on Colorado, complete with maps and mileage logs. Rock hunting areas of Colorado are also well illustrated in *The Western Gem Hunters Atlas* written and published by H. Cyril Johnson. Another fine publication is *Minerals of Colorado*. A 100-year record, Washington, D.C., U.S. Printing Office. Price \$2.00, plus postage. These fine publications are very handy to have when you make that trip to Colorado.

Colorado has been a prolific mineral producing state, and although mining is in the doldrums at present, the thousands of tailings dumps that dot the rocky mountains, bear mute evidence of years of prospecting and mining. It is one of the largest producers of gold, silver, lead, zinc, copper, uranium, vanadium, and molybdenum. It is also a large producer of coal, petroleum, marble, and granite. In many areas you may be permitted to dig around in these old abandoned mine dumps, but it is wise to make inquiries of the natives and get permission where necessary. Where buildings and equipment still exist, it is prudent not to enter or molest the property. Above all, please stay clear of vertical shaft openings, as any covering or the walls of the shaft may be ready to collapse at any moment. It is also wise to stay out of horizontal tunnels or inclines also, even though everything looks safe enough. After standing many years, support timber may have rotted, and walls are air slacked and ready to cave. Another danger is gas or lack of oxygen. However, you may find a lone miner now and then who may let you go down into the mine with him to see what a hard rock mine is like. In some mining camps you may find advertised trips into a mine for a fee. Where a company is operating a

mine, the policy is almost invariably, no, mainly for liability insurance reasons.

The early day miner usually saved only the richest ores because of expensive transportation, and therefore many an abandoned dump may contain some fine specimens. Crystals of quartz, calcite, selenite, etc., were seldom saved and were dumped in the waste dump. Blasting and rough handling have damaged most of them, but often they have been protected inside a vug in a piece of rock.

In its varied formations, Colorado has produced a great variety of mineral combinations from its great sedimentary deposits to its pegmatites. Writing about its mineral specimens would fill many volumes. We are chiefly concerned here with its cutting materials. We will divide the state into five sections (see map) for easier description.

In the N.W. corner of the N.W. section you will find the Dinosaur National Monument which occupies a strip along the Yampa River, and of course, collecting is prohibited within the monument. The headquarters of the monument is in Utah, near Vernal. A trip through this graveyard of the dinosaurs will show you millions of years of geology. It will also acquaint you with the various formations you may look for to find agate, jasper, petrified wood and dinosaur bone in the region between the monument and Hiway 40 from the Utah line to Maybell. Southward and into the "Four Corners" stretch the Great Colorado Plateaus, a region made famous during the great uranium boom, a land of spectacular canyons and high plateaus, and the graveyard of prehistoric dinosaurs and forests. Rifle, Colorado, on Hiway 24, is in the great oil shale country where the U.S. Government has a reserve of millions of barrels of petroleum locked in nature's shale vault. Pieces of this shale, when cut and sanded smooth, make unusual book ends and paperweights. The rugged Rocky Mountain National Park may be inspected by turning off Highway 40 onto U.S. 34 which goes through the park. This is a must, if you are anywhere near this part of Colorado.

As we enter the N.E. section we must mention the beautiful alabaster found north of Fort Collins on Hiway 287 in Owl Canyon. This material has a mottled buff beauty and can be carved easily. It has been worked commercially and fashioned into lamps, bowls, book-ends and many ornaments. East of Fort Collins near Stoneham is the famous Colorado Blue Barite location. These beautiful, fragile, transparent, blue crystals are hard to come by, but worth working, for the location is on private property and permission to dig must be obtained. Also in this general area of the South Platte River, agates, jaspers and petrified wood may be found. An especially good area is along

Hiway 52 between New Raymer and the Wyoming border near the Pawnee Buttes. You are now in part of the Great Plains, which cover all of eastern Colorado, one time the home of the Plains Indians, antelope, and buffalo.

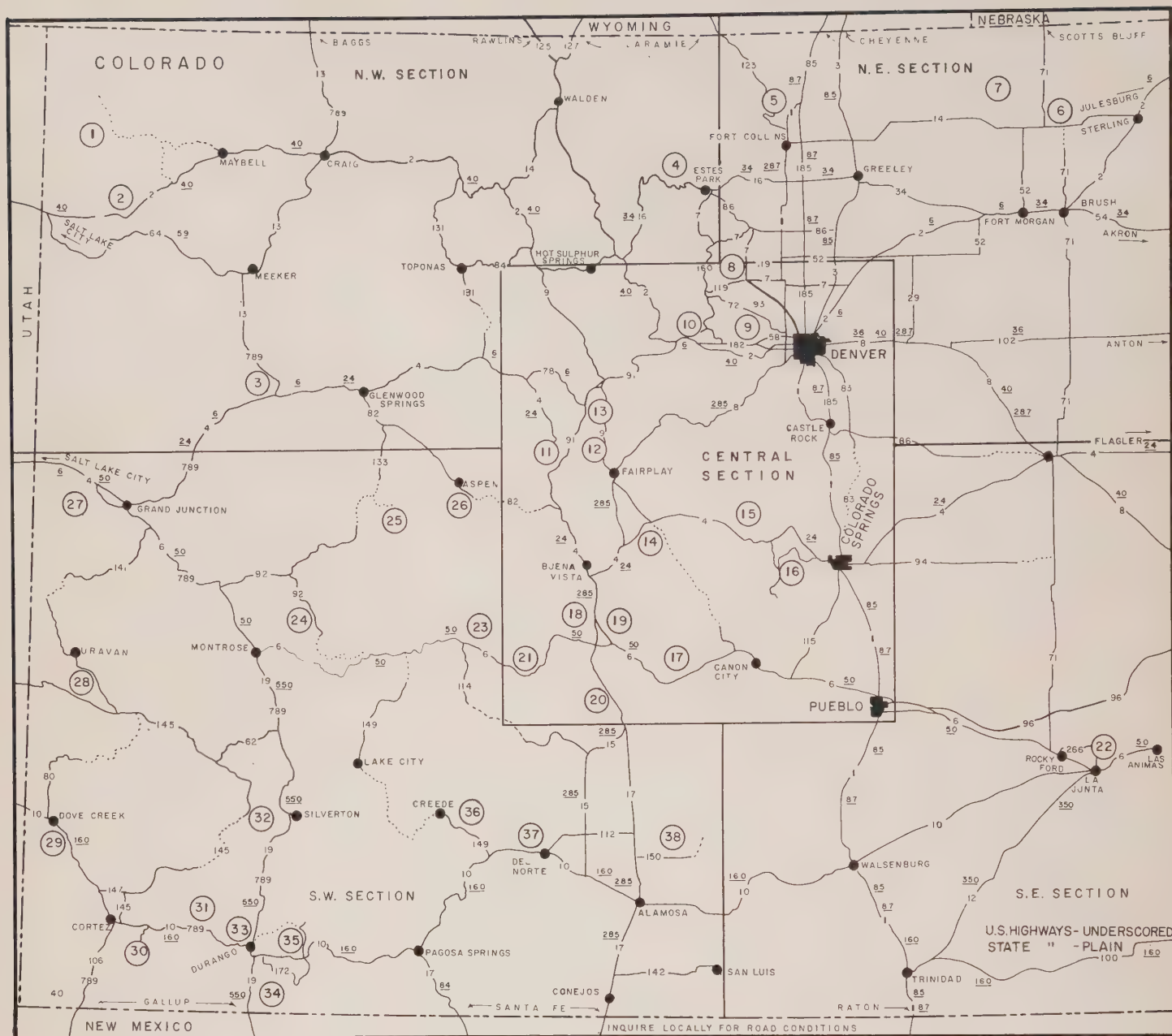
Now we enter the central section of Colorado, in which we find the "Mile High City" of Denver, the state's capitol. This is quite an interesting section because of the great mineralized area to the west and south of Denver. Northwest of Denver is the Boulder mining area, once the leader in tungsten production. Permission must be secured to search most of the dumps in this area, but you may get lucky and find a good specimen of purple fluorite or ferberite in some of the dumps. West of Denver near Golden are the Table Mountains, where fine specimens of many different zeolites may be found in the basalt lava beds. Richard Pearl describes this area very well in his book, "Colorado Gem Trails." Farther west is the Central City-Idaho Springs mining area. This area is literally dotted with mine dumps, and interesting quartz crystals may be found in some of them. Northwest of Leadville is a turquoise property known as the Turquoise Chief Mine. Some good turquoise has been mined here. The mine has been worked sporadically for some time but was never a big producer.

East of Leadville is a range of mountains over which a burro race is held each year between Leadville and Fairplay. Fairplay is an old mining camp which has a statue to a burro named "Prunes." A few miles northwest of Fairplay is the old mining town of Alma. Fabulous veins of rich gold ore were mined here, the London and American mines being the best known. Also near Alma is the Sweet Home Mine which produced some of the finest rhodochrosite crystals known. They are beautiful bright red, transparent crystals of great beauty. Some of this material was so fine and clear it is still in great demand for facet-cutting. The mine has been caved in for some time, but it may be possible to scratch out a small piece from the dump.

Over Hoosier Pass north of Alma lies the town of Breckenridge, the town which at one time claimed it was not a part of the United States because of an old Spanish land grant. This area is the source of the world famous "Breckenridge or Farncomb Hill Crystallized Gold," a fine collection of which is in a vault in the Denver Museum of Natural History. Even when this area was producing, specimens of this crystallized gold sold for as much as ten times its actual gold value.

South of Fairplay, Highways 285 and 24 split at Antero Junction with Highway 24 leading east through Hartsel, Lake George, and Florissant into Colorado Springs. Near Antero Junction is a de-





#### KEY TO MAP - COLORADO

- 1—Dinosaur National Monument.
- 2—Collecting area, agate, jasper, etc.
- 3—Oil shale.
- 4—Rocky Mountain National Park.
- 5—Alabaster—Owl Canyon.
- 6—Blue barite.
- 7—Agate, jasper, petrified wood.
- 8—Boulder area.
- 9—Table Mountain area.
- 10—Central City-Idaho Springs area.
- 11—Turquoise.
- 12—Rhodochrosite and gold.
- 13—Farcomb Hill—crystallized gold.
- 14—Hartsel area, travertine, jasper, agate, blue barite.
- 15—Lake George—fluorescent area, pegmatites, fossil beds, petrified forests.

- 16—Pikes Peak area, pegmatites.
- 17—Canon City-Salida area, dinosaur bone, agate, travertine and pegmatite minerals.
- 18—Mt. Antero, pegmatites, aquamarine, bertrandite, phenakite, etc.
- 19—Ruby Mt.-Turret district, garnet, epidote, quartz, etc.
- 20—Villa Grove, turquoise.
- 21—Red Granite, pegmatites.
- 22—La Junta area, petrified bone, wood, agate, jasper, alabaster.
- 23—Ohio City-Gunnison area, pegmatites, tourmaline, topaz, beryl, lepidolite.
- 24—Black Canyon of the Gunnison Nat'l Monument.
- 25—Marble quarries.
- 26—Aspen, silver mines, winter sports.

- 27—Colorado National Monument.
- 28—Bone country, uranium, coal, vanadium.
- 29—Pinto bean capital of the U.S.A.
- 30—Mesa Verde National Park, cliff dwellings.
- 31—La Plata Mountains, Tellurites.
- 32—San Juan mining region, Rico, Tellurite, Ouray, Silverton, gold, silver, lead zinc, copper, rhodonite, rhodochrosite.
- 33—Durango, narrow gauge railroad capital.
- 34—Ute Indian Reservation, oil, gas and Indians.
- 35—Gem Village, rockhound community.
- 36—Creed-Wagon Wheel Gap area, amethyst, silver, fluorspar, creedite, gearsutite.
- 37—Del Norte area, thundereggs, plume agate, opal, etc.
- 38—Great Sand Dunes National Monument.

posit of travertine and scattered pieces of jasper and agate, some of which is quite nice. Near Hartsel is a deposit of Blue Barite in decomposed limestone clay. The blue crystals are pretty, but not quite as fine as the Stoneham blue barite. Agate and jasper also may be found in this area. East of Hartsel you start getting into the Pikes Peak granite pegmatites. This is a very interesting area around Lake George and Florissant, with their Tarryall Mountains and crystal peak gem deposits. Smoky quartz, milky quartz, amazonstone, topaz, amethystine, quartz, fluorite, phenakite, and muscovite crystals may be found in this area, some of very fine quality. The famous Florissant fossil beds attract thousands

of fossil collectors because of the great variety of fossils found there.

South of Florissant are the Colorado petrified forest, and the Pike petrified forest, famous for standing tree stumps. The petrified wood is not gem quality, but the largest standing petrified stumps in the world are here. Samples of wood may be picked up in places outside but not within the closed areas named.

East of Florissant is the Pikes Peak region near Colorado Springs. This area of Pikes Peak granite, webbed with pegmatites has been known to collectors for many years. However, many beginning collectors are not aware of the fine amazonstone, topaz, zircon, quartz and other

related pegmatite minerals that may be found in this region. Gem pockets may still be found in places by the serious collector or specimens may be found in the gullies and washes of the foothills by the diligent searcher. These specimens having been dumped as gem pockets, were exposed as mountains wear out and gravity carries the fragments to lower levels.

The Pikes Peak region is quite large and is, of course, subdivided into several collecting and mining areas, Crystal Park being the best known as a source of phenakite and some zircon in company with the topaz, amazonstone, etc., which are typical of the Pikes Peak pegmatites.

Farther south is the St. Peters Dome



area containing much the same minerals and crystals in the pegmatites, but here the zircon is a better grade and fine colored gem crystals have been found here.

From the Colorado Springs-Pikes Peak region we move to the Canon City to Salida region. This is a 60 mile stretch of Highway 50 loaded with a number of mines and quarries. Just north of Canon City is the Garden Park area, well known for its dinosaur bone quarry and its variety of agate in geodes and in vein type. This area will give you a first class lesson on how to recognize the Morrison formation. This formation produces the best petrified bone wood and agate in Southwest Colorado and Southeast Utah. Learning to recognize the Morrison formation may lead you to a new find because this is very likely wherever this formation is exposed. The Morrison formation is also a uranium-bearing stratum which was extensively prospected during the uranium boom. The author has heard many tales from ex-uranium prospectors of finding the entire agatized skeleton of a dinosaur either partially or wholly exposed, miles from any road. Now they don't know how to get back to the find, because at the time, they had no interest in anything but uranium. There is plenty of petrified wood, bone, jasper and agate left in Southwest Colorado, not alongside the paved highway, but back in more remote areas where it takes work to get it, but a good find is worth the effort. About the same distance south of Canon City is Curio Hill which is a fine agate area.

As you head west toward Salida you pass a travertine deposit where huge blocks of fine material has been quarried commercially for building blocks. Small material is used for beautiful terrazzo floors.

Farther west we enter the Royal Gorge district. The Royal Gorge itself is a spectacular sight with the Arkansas River winding in the bottom and its beautiful pegmatites showing on the walls. A great deal of mining and prospecting has been done in this area. The pegmatites are very coarse and unusual, containing in places, a long list of unusual minerals. The graphic granite of this area is very attractive. Richard Pearl lists a long list of minerals which were classified by Dr. Heinrich, making this an extremely interesting area to visit.

Between the Royal Gorge and Salida are the Devil's Hole Mine, and the Cotopaxi Mine. At the Devil's Hole, beryl, columbite, tantalite, feldspar and mica were produced. This mine also produces a good grade of rose quartz along with the other pegmatite minerals peculiar to this area, some of which were found in giant sizes.

At the Cotopaxi mine, while not so far from the Devil's Hole, the formation is quite different. Lead, Zinc, and copper ores were mined here and the dumps still produce a few gahnite crystals.

At Wellsville, seven miles out of Salida, is Colorado's largest travertine deposit, producing building blocks and the fines being processed for use in refining beet sugar.

A short distance north of Salida are several important areas, Mt. Antero, to the northwest, and directly north are the Sedalia mine, the Trarret district, Ruby Mountain, Sugar Mountain, and Dorothy Hill.

Mt. Antero, over 14,000 feet in elevation, is a rough, rugged area where aquamarine may still be found in its scattered beryllium deposits. Good gem grade aqua has been mined from this area. Bertrandite and phenakite also occur in the Antero pegmatites.

The well shaped dodecahedron crystals of almandine garnet which are so often referred to as "Salida garnets," come from the Sedalia mine. These huge garnets are known for their fine shapes rather than for gem material. They are abundant but hard to release from the Chlorite Schist in complete crystals. This mine was once an important copper producer.

From the Calumet Mine in the Turret district come very fine epidote crystals, sagenitic quartz crystals and a variety of garnets. A complete list of minerals found here would make a complete story in itself.

Turquoise is or has been mined in several places in Colorado, but the finest quality in the state and equal to anything in the United States, is mined near the town of Villa Grove, which lies on Highway 285. This mine is privately owned and being operated at the present time and collecting is prohibited. The mine has been known as the Hall Mine and also by other names but the turquoise is known as Villa Grove Turquoise. It is a beautiful blue but well scattered in small spots in the hard matrix, which results in much labor being spent to secure a pound of gem material. Its hardness and beautiful blue color make it a favorite with Zuni Indian silversmiths who use it in their beautiful cluster work, scores of miniature stones sometimes being used in one piece of jewelry.

The drive from Salida to Gunnison on Highway 50 takes you over the Continental Divide at Monarch Pass which is over two miles high and continues west through beautiful red granite country laced with pegmatites. This attractive red granite is plentiful and can be worked into fine spheres, book ends, paperweights, etc. More will be said about the Gunnison area in describing the Southwest section.

We skip now to the Southeast section, which lies mostly in the Great Plains, with the exception of the Southwest corner of the section, which contains the southern tip of the majestic Sangre De Cristo Range. Petrified wood may be found over a wide range in the plains area of this section. In the vicinity of La Junta one may find dinosaur bone. This area also produces some fine alabaster and Colorado's rose agate. The alabaster has been commercially worked for many years and made into lamp bases and ornaments. A large percentage of the so-called "rose agate" is poor, but choice pieces of it will cut into spots that cannot be matched anywhere else in the United States.

The Southwest section is one of the most attractive sections of the state. If a collector is willing to work and get away from the highways, a large variety of materials may be found. This section is full of lakes, rivers, forests, plateaus, and even desert-like sand dunes at the Great Sand Dunes National Monument northeast of Alamosa. The Continental Divide separates the great potato-growing San Luis Valley from the oil, coal, and uranium-rich region bordering Utah. In between the Continental Divide and the western plateaus lies the majestic San Juan range

of mountains, dotted with colorful mining camps which have produced many of our important minerals, gold, silver, lead, zinc, copper, manganese, tungsten and iron pyrite for sulphuric acid.

Twelve miles east of Gunnison, Colorado 162 leaves U.S. 50 and heads toward Ohio City and the Quartz Creek pegmatite district. This area is literally laced with pegmatites in which have been found watermelon-pink microlite and black tourmaline, muscovite, topaz, beryl, and lepidolite. Many of the pegmatites have been worked and one should get local information on collecting possibilities.

Between Gunnison and Montrose is the Black Canyon of the Gunnison National Monument. North of Gunnison and east of the once silver-rich and now skiing-famous town of Aspen is the town of Marble. As the name suggests, this is the home of the fine white marble from which the Tomb of the Unknown Soldier and the Lincoln Memorial were built. Marble from the quarries here went into many public buildings in the U.S. Great amounts of pieces too small to block lie in the waste dumps. It is wonderful material for carving.

Just west of Grand Junction is the Colorado National Monument and from there to the Utah border and southward to Dove Creek, the pinto bean center, is dinosaur bone country. Tons of colorful, agatized and jasperized gem-grade bone have been taken from this area as well as many fine specimen vertebrae and joints. Plenty of bone remains, but not easy to get to any more. It's like gold. "It's where you find it." The area also contains opalized and agatized wood, agate, and jasper. This area is also a great uranium, vanadium, oil, gas and coal producer. Down in the southwest corner are monuments to the cliff-dwelling and pueblo-dwelling Indian. The Hovenweep National Monument is not as accessible as the Cliff Dwellings of the Mesa Verde National Park. In the very southwest corner is one-quarter of a monument, the one place in the United States where four states meet, the rest of the monument being in Utah, Arizona, and New Mexico. The New Navajo Trail Highway from Cortez to Flagstaff passes by it. The Sleeping Ute Mountains may be seen from here, but the best view of why the mountains were so named is seen from Cortez, the greatly improved U.S. Highway 160, (part of the Navajo Trail), runs from here completely across the southern end of the state from Utah to Kansas.

Between Cortez and Durango are the La Plata Mountains, rich in native gold and telluride ores. Fine specimens of sylvanite, calaverite, etc., have come from the mines in this area.

From Cortez you can go north on Highway 145 on a trip through the San Juan mining region. The trip will take us through Rico over Lizard Head Pass through Ophir to Telluride. A jeep can take you over the mountains to Ouray or you can go around through Ridgeway into Ouray and from here to Silverton over colorful Red Mountain Pass, then south to Durango through beautiful country where many movies have been made, especially movies requiring scenes of pioneer railroad building.

Rico was principally lead, zinc, and silver producing camp, but all of its production carried some values in gold. Many



fine specimens of the various combinations of these four minerals were extracted but very few were saved. Specimen collecting was not very important then. However in those days, one mineral had no value and was discarded on the dump as iron pyrite. Huge beds of iron pyrite exist under Telescope Mountain and many fine perfectly shaped individual crystals and groups have come from here. At the present time, iron pyrite is being processed in Rico for sulfuric acid and collecting is prohibited.

Ophir has produced some very fine wolframite specimens. The mines are not working there now. The mines around Telluride were principally gold producers and many cabochons have been cut from the native gold in white quartz from the mines here. Pink calcite with a fine fluorescence under both long and short wave lamps also come from this area. At present, the Colorado Mining Company is operating a mine. The main tunnel of this mine goes completely through the mountains from the Telluride side to the Ouray side. The long tunnel it took to go through the mountains produced quite a large dump on the Ouray side. This tunnel is called the Treasury Tunnel and the dump contains many fine specimens of quartz, calcite, and fluorite. The fluorite and calcite both fluoresce. Permission is sometimes given to search the dump.

Ouray calls itself the "Switzerland of America," and a beautiful place it is, with rental jeeps to take you into never to be forgotten mountain scenes. Many mine dumps surround Ouray with their quota of specimens. Once in a while even a nice gold specimen is found. The Highway from Ouray to Silverton is called the "Million Dollar Highway" because it is estimated that a million dollars worth of low grade gold ore was used to gravel the original road. Mine dumps dot the hillsides all the way over Red Mountain Pass into Silverton.

The Silverton area is best known to collectors for the great quantity of pink rhodonite found near there, and for its very fine rhodochrosite and octahedral fluorite crystals which have appeared in several of its mines. The area has also produced some fine huebnerite specimens.

From Durango, "The Narrow Gauge Capitol," you take Highway 160, "The Navajo Trail" east. Eighteen miles east of Durango is Gem Village; a community founded by Frank and Grace Morse for rockhounds. This is the first community in the United States founded for that purpose. Two miles west of Gem Village the Pine River runs through the town of Bayfield. Where the Pine River crosses under the highway, the Bayside Lions Club have constructed a free tourist camp ground on highway property, complete with running water, tables, stoves, night lights, rest rooms, and information booth under the full time supervision of the very able Mr. Cook, who has that unique ability to make all guests feel at home. Inquiries may be sent to the Bayfield Colorado Lions Club, Bayfield, Colorado for any information. The Pine River gravel contains some very beautiful boulders of all sizes of a hard conglomerate. This material is very hard for conglomerate and is made up of reds, whites, and browns. Most of the river in the vicinity of the Lions camp is privately owned, but some owners will give permission to hunt.

The Piedra and San Juan Rivers occasionally produce some fine agate, some clear, some banded, and once in a while some very fine green moss. Somewhere at the headwaters of the Piedra are some very good sources of agate, which some rockhound will find someday. The volcanic area from here, through the Continental Divide to the Saguache area produces chalcedony, common opal, and thunder-eggs. Hunters and stockmen with little real interest bring out unusual pieces now and then, but the area has not been searched well by a serious rockhound. The country is very rough and must be covered on foot or horseback. Reports of finding fire opal are occasionally heard. However, the author has never seen a piece of fire opal from this area.

Wolf Creek Pass between Pagosa Springs and Del Norte, has produced some agate and natrolite in nodules in a spot where the state highway blasted through solid rock for U.S. 160, but by now most of the rubble has been searched and little remains to be picked up.

Northwest of South Fork is the Wagon Wheel Gap and the Creede areas. The fluor spar mines at Wagon Wheel Gap are not working now and the property is posted, but from these mines have come some fine fluorite and rare creedite and gearsuite specimens.

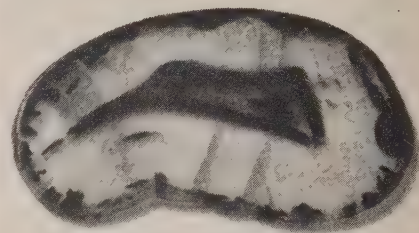
Creede is a famous Colorado mining camp, where the assassin of Jesse James met his "Waterloo." Creede was a great silver producer and the veins also produce amethyst. Collectors may still find good cutting grade amethystine quartz on the dump of the amethyst mine.

One of the most interesting agate areas in the S.W. section is a few miles northwest of Del Norte. Here, eroding out of the volcanic rock, are thunder eggs from fist size up to 200 or 300 pounds in weight. These huge eggs are much different than Oregon eggs. The lines on the outside are much the same but the agate content on the inside is usually much less. The agate is mostly transparent or has a bluish-gray color sometimes half agate and half white opal. Some will contain a fine moss. The greatest find, however, is to find one with a very attractive plume. A single plume may have a black stem, brown or yellow foliage and red flowers on the tips. A choice cabochon of Del Norte plume is the equal of, or better than, any plume in the United States. Like most fine plume, it is scarce. Claims have been staked and worked here. Some claims are still active and some have been dropped. L. V. Love of Monte Vista has valid claims in the area at this writing. Mr. Love has probably worked more Del Norte agate than anyone else, and top quality plume cabochons cut by him have gone all over the world. Another type of agate, overlooked by many collectors is flat layered agate that usually looks worthless. However, manganese has seeped into the flat layers of some of this material and has produced extremely fine dendritic patterns between the layers. Cutting across the layers does not expose these dendritic patterns. The agate must be sawed parallel to the layers. Although private claims cover some of this area, there is still a lot of ground to collect on. On the tops of little knolls at the foot of the mountains, many pieces of agate, opal and jasper may be found. Anyone going into this area should inquire as to the whereabouts of

boundaries of private property.

You will find the people of Colorado a very friendly people. Follow the rules and you can have a very enjoyable vacation in this colorful state. There are many active gem and mineral clubs in the state whose members will show you every courtesy. Assistance and information will be offered to hobby collectors, but commercial collecting is frowned upon.

Many Colorado people may feel that their favorite area has not been mentioned in this article, for which apologies are offered, because it would take a large volume to contain all of the Colorado locations. ⊕



## UNUSUAL "BIRD AGATE" FOUND

A Montana agate, which when sliced across, revealed a perfect head of a heron, in type like an Eastern Green Heron, but with red head, black top and bill, is the prize of Raymond G. Horner, 547 Valley View Road, Towson, Maryland. It is not unusual to find pictures in stones . . . the imagination of the viewer must sometimes be stretched to see them, but in this case, there is no trouble at all in seeing it. ⊕



## MINNESOTA MAP IN OREGON AGATE

What could an almost perfect image of the outline of the State of Minnesota possibly be doing in an OREGON agate, especially when the agate was formed millions of years ago, long before the world was peopled by anything except crawling trilobites. It is just one of those strange happenstances which occur to intrigue the rockhound. There is nothing quite so fascinating as watching successive slices come off a slabbing saw when they present varying no-two-exactly-alike pictures. (Now someone is SURE to come up with two exactly alike slabs to refute even this!)

The Minnesota outline map reproduced here was found by David Marshall, owner of Marshall's Rock Haven, 2182 Aztec Lane, Saint Paul, Minnesota. ⊕



# GUIDE TO THE AGATE FIELDS OF BEDFORD CO., TENNESSEE

*By Virgil S. Owens*

217 S. Anderson St., Tullahoma, Tenn.

The state of Tennessee is not particularly outstanding for its mineral localities and when the lapidary thinks of gemstone material locations in the United States, he usually visualizes some of the states west of the Mississippi River. It is a fact that there are some occurrences of good cutting material in this state, the best item being, possibly, the agate described in this text. This agate is found in the hills of Bedford County, Tennessee, and appears to be pretty well restricted to that area. Strictly speaking, this material may be more properly classified by the use of the term, chalcedony, since it is a geode type of formation. This chalcedony is translucent to a great degree and exhibits a fine banded structure. The material is hard and tough, is free of soft spot or voids and polishes beautifully. Varieties of this chalcedony include carnelian and rainbow iris agate, the quality of which is equal to that from any locality. This agate is found over an area of several square miles and exists in fair quantities, so that it may be possible for all interested collectors to obtain a sample of this material.

We shall, in this writing, attempt to give you complete information as to localities, facts relating to the material and methods of working it, insofar as our experience will permit. We shall begin this treatise with a short chapter on the geology of this section for the benefit of those who are interested in this phase of the subject. Next we will try and give you a description of this material, its varieties and the merits of the different types. Then we present matter relating to the particular localities, methods of hunting, etc. Lastly, we give you our thoughts on the lapidary treatment of the material that is found here.

At this point, I would like to touch on the nomenclature of the material of this section. All good agates are given some special name. This name is usually either descriptive of the material or refers to the locality in which it occurs. The group of higher ridges of this section in which the agate occurs is often referred to as the "Horse Mountain." From the foregoing, I propose the name *Horse Mountain agate* for the chalcedony of Bedford County, Tennessee. This is a distinct type of agate and this name will serve to indicate the locality from which it is taken.

## GEOLOGY

The rocks of this area of Tennessee are all of the sedimentary type. The formation in which the agate occurs is of the Ordovician age and in this area consists mainly of crystalline limestones. The bed or strata in which the chalcedony is formed is composed of fine quartz grains cemented by calcium carbonate. The lime is soon leached out, where exposed to weathering, leaving a rock that is about 98% silica. These rocks are of a light tan to brown color and have the appearance



*Rough specimens of Horse Mountain agate.*

of a fine textured sandstone. After the lime is leached out, the stone cracks and breaks up into smaller and smaller pieces, finally turning to dust. This weathering or break-up of this strata exposes the geodes that are contained in these beds. Thickness of this strata runs up to around 40 feet and, in most cases, the agate is most plentiful where the beds are thickest. In most instances, this siliceous strata contains some thin beds of flint, randomly intermixed. The silica material composing these beds is possibly of diatomaceous origin.

To be specific, the strata referred to above is the Hermitage formation of the Ordovician age group. This formation is present in several of the Eastern states though the character of the rock varies somewhat from place to place. Outcrops of the Hermitage formation are quite widespread in Central Tennessee, however, at most points, it is of a slightly different nature from that of the area described in Bedford County. For the most part, exposures of this strata appear to be more shaly and contain less silica material, and occurrences of agate are rare or nonexistent outside of this area. The Hermitage formation does furnish some nice specimens of silicified fossils at several points in this state.

Statements as to the origin of this agate are in the nature of theory, however, it appears that this chalcedony was deposited from ground water solution. Further, it appears that the geodes are a replacement of a mass of crystalline calcite that once occupied a space in the rock.

## VARIETIES AND DESCRIPTIONS

The agate in this section occurs in the form of the geode. Size varies from that of a marble up to specimens of possibly 12 inches. The largest whole geode that I have seen up to now, weighed 16 pounds. For the most part, the agate is found as fragments of geodes, since they are broken up in weathering out of the parent rock. The majority of the geodes consist mainly of chalcedony, however, some are encountered in which bands of crystal alternate with bands of chalcedony. In many pieces, the geode is mostly chalcedony with a crystal lined cavity in the center. Occasionally a geode will be found which is composed entirely of crystal.

On the average, the agates of this section are not particularly colorful, however, a good portion of this material will exhibit interesting light effects when cut and polished. About half of the agate found here will be almost clear with a slight bluish or smoky tinge. Colors run yellow to amber and smoky to an almost black with now and then a good red shade. The material is solid in color, that is, it does not show the color variation of the bands that is seen in the average agate material. There is some slight variation in the shade and density of the fine bands, however, it is so slight that the overall appearance is that of solid color. As found in the field, this agate will quite often show a white weathered exterior in which the different bands stand out plainly, however, this is only a surface coating. The black material appears to be opaque in larger pieces but when slabbed it is trans-



lucent and the color is somewhat like that of champagne.

A good portion of the clearer material, when properly cut, will prove to be iris agate. For those not familiar with iris agate some further discussion may be in order. The term, "rainbow iris agate" is used to designate those translucent chalcedonies which have the proper structure to separate light into its component colors. In other words, when a thin slab is cut at right angles to the bands and polished, one may look through it towards a good source of light and see all the colors of the rainbow. On the average, this feature is somewhat rare in the agates of the world, however, it seems to be fairly common in the agate from this locality.

There are several theories to explain the phenomenon of iridescence in chalcedony. The most tenable one seems to be that the fine bands act as a diffraction grating and separate light into its component colors. It has been noted that those pieces which cut iris agate show a fine banded structure whereas those of coarser bands fail to produce any rainbow. A good specimen of iris agate will show all the seven primary colors of the spectrum. This is said to be the only mineral that exhibits this feature. It is rather difficult to tell by viewing a specimen, whether or not it will cut iris agate. A person who has had a great deal of experience in cutting this material may be able to make a pretty good guess as to which piece of rough will cut iris agate and which will not. The surest way is to cut a thin slab and look through it towards a good source of light. Further hints on the handling of the iris type of agate are given in the chapter dealing with lapidary treatment.

One interesting variety of the chalcedony of this area is the fine quality carnelian. The term, "carnelian," refers to those translucent chalcedonies of solid color in shades of cherry red to orange red. A minor portion of the chalcedony found in this area will show the carnelian shade and the quality is very good and, so any specimens that are collected should be highly prized. The term "sard" is used to designate those chalcedonies of a brown or amber shade. These lighter shades are found here along with the carnelian.

Another interesting feature of the agates from this vicinity is the fact that some of them enclose dendritic figures or moss-like growths. The term, "moss agate" is used to designate those chalcedonies exhibiting this feature. The percentage of agates from this locality which show the moss is not large, however, they are unusual in pattern and make nice specimens when properly cut. Further reference to the subject of moss agate is given in the chapter dealing with localities and hunting methods.

Turtleback agate is quite common in the material of this section. The term "turtleback" applies to inner planes of a translucent structure seen in certain chalcedonies. The appearance of the planes is similar to that of a turtle shell, hence the name. These planes are geometrical shapes bounded by straight lines. This feature is more noticeable when looking through a slab or polished piece, however, it does seem to add to the opalescence or cat's-eye effect of a cabochon.

#### LOCALITIES FOR HUNTING

The agate area of Bedford County lies to the east and north of the city of Shel-



*View of Horse Mountain looking towards Shelbyville from Pannell ridge.*

byville, the county seat. This area, for the most part, lies between the Fairfield pike and Tennessee highway No. 64. Fairfield pike leads from the town of Shelbyville to the village of Fairfield and highway 64 leads from Shelbyville, via Wartrace, to Beechgrove on U.S. highway No. 41. The area may be approached from four roads leading out of Shelbyville, namely, Fairfield pike, Horse Mountain road, Railroad avenue and highway 64. From the intersection of highways U.S. 231 and U.S. 41-A in Shelbyville, go south on 41-A towards Tullahoma, at first traffic light from above intersection, which is Deery street, a left turn will lead into Fairfield pike. Going further out on 41-A, at third traffic light which is Whitthorne street, a left turn leads to Horse Mountain road. Still farther out 41-A crosses a railroad track and just after crossing this track, take a left turn and you will be on Railroad avenue which follows the railroad for a few miles. You may follow 41-A still farther and shortly after leaving the city limits you will arrive at the intersection of 41-A and 64, a left turn here will lead to the city of Wartrace. The various localities may be reached from one or more of the above roads.

The Pannell ridge section is a very good area as the agate may be found in all the valleys which originate on this ridge. Most anywhere in the vicinity of the Horse Mountain road, from the mountain to within a couple of miles of Wartrace, is pretty good hunting. The section around Phillipi church, is also pretty good. The Stokes branch section near the city of Wartrace may be reached from Higgins road, which runs from highway 64 near Wartrace to the Horse Mountain road. There is one area just north of Fairfield which is a good producer, although located some distance from the main fields.

The agate of this section may be found in the fields and stream beds of the area. The best hunting is in a plowed field after a good rain, however, this condition is seldom met with. A good portion of the agate areas are in pasture land and meadows, some in woods, which makes hunting a little more difficult. In all cases, permission of the land owner should be obtained before going on the property. There are no public lands in this section, all is private property and for the most part the land is divided into small holdings. There are a few farms in the area which permit hunting on a fee basis. As in all areas, the rules of the Rockhound's code of ethics are proper here.

In hunting the fields, the agate is found on the surface. In some cases, only a small portion of the stone may be seen and for

this reason a good practiced eye is helpful in obtaining a full bag. The agate is usually weathered to some extent on the surface, giving it a white coating which is easily recognized after one has seen a few pieces. In some instances a piece may be found showing a recent break and in this case the stone will show the waxy luster of chalcedony. The material found in the fields will run more to the clear and light shades. This is true of the larger pieces, however, some small pieces may be found showing shades of yellow, orange and red. These small pieces are quite often of the proper size for a cabochon or baroque.

The agate found in the stream beds is, on the average, deeper in color than that found in the fields. In the stream gravels, the weathered exterior of the stone takes on an orange to amber color. There is lots of flint in the stream gravels and you may distinguish the agate by the fact that it usually shows the fine banding. The agate found in the stream beds may be yellow, amber, black or red and it is here that we find the best carnelian. The agate that has lain in the stream beds for a long period of time will, quite often, show dendrites or moss patterns. These are mostly near the weathered surface or along fracture zones. It appears that this agate picks up color and dendrites as a result of long exposure to the elements and those pieces that have lain in the stream beds for the longest period of time will be the most colorful.

The best time for hunting the stream beds is during late Summer and Fall. During this period the water is low or absent from the streams and it is possible to walk in the bed. The Winter flood waters move the gravel along and expose new material each year. Of course, after being hunted over for some time the agate will become scarce on the surface. The only recourse in this case is to dig into the gravel for additional material. There are many spots along the streams where rock and gravel have accumulated into large beds and these may be dug into with good results. The upper portion of those streams which originate around Pannell ridge are good producers of agate. Butlers creek and tributaries are also fair hunting. The gravels along Stokes branch contain some agate from the mouth of the creek to the upper reaches. It is possible that there are other areas of this section that I have missed.

#### LAPIDARY TREATMENT

The agates of Bedford County present no particular problems in cutting and polishing. The paramount requirement in working this material is patience and persistence, it is a little slower to saw and





*Tumbled polished Horse Mountain agate.*

grind than the average quartz gemstone. It is not easily fractured and will stand up well under any heat resulting from grinding or sanding. All in all, it is a most satisfactory material to work with and the beauty of the final polish that may be put on it is most pleasing. One point that may be stressed, at this point, is the fact that this agate is translucent and the flat back of cabochons should be given the best polish possible. The better the polish on the back, the better glow or opalescence that the cabochon will show.

At this point, we will go into the cutting of rainbow iris agate, since this is one of the interesting varieties of agate from this location. It is practically impossible to identify iris agate in the field so we must resort to some lapidary treatment in order to know if a certain piece will show iris or not. The best means is to cut a thin slab and polish it. If it is iris agate, you can look through it towards a good source of light and see the beautiful play of colors as the slab is moved slightly up and down. Since this procedure requires some time and work, we need some short cuts or quicker means of identification. Iris agate is usually found in those pieces which show a fine banded structure on the surface and is usually somewhat clear. Another clue for iris is the fact that, more often than not, the iris section is adjacent to a crystal section of the geode. To sum up the matter, when you find a piece of clear material showing a fine banded structure and which contains a center of crystallized quartz, then you have a good prospect for iris agate. Experience in working with this variety will better your ability to judge the qualities of a prospective piece in the rough.

Once we have picked out what appears to be a good prospect for iris agate, the next step is to saw a thin slab from it. The important thing here is to saw at right angles to the bands. In other words, the slab should be oriented in such a way that when looking through the slab you will be seeing through or between the bands, in a similar manner as when looking out a window over which there is an open Venetian blind. In larger pieces you will find that it is practically impossible to saw at right angles to all the bands as there is a great deal of curving and change of direction of the bands. Just try and saw at right angles to the bulk of the bands or the bands in the region which show the iris. The material should be closely observed and studied as slabbing proceeds so that the angle of cut may be changed

whenever necessary. Once a slab is taken from the rough it may be tested by cleaning the slab and dipping it in kerosene and looking through it towards the light. Kerosene or other light oil will allow the light to pass through sufficiently to show the iris. If a trial slice shows some iris then you can proceed with slabbing the balance of the stone as any bands that show the iris in the trial slice will be the same throughout the piece. Then iris effect is better seen in very thin slabs, so for specimen pieces it should be cut from 1/16 to 1/8 of an inch in thickness. For working into cabochons or other shapes you will need a little thicker slab, say about 3/16 of an inch.

There is a short cut method of identifying iris agate which may be used after one has gained some experience in working with this material. This consists of flaking off a thin chip at a point where the bands are properly oriented, dipping the chip in kerosene and holding it out at arms length toward a good source of light. The chip should be moved slowly up and down, if the material is good iris agate the chip will show some color. The chip should be thin and the tester should have had some experience in viewing iris agate in order to catch the least bit of color at a glimpse.

Carnelian is a gemstone that has been cut and admired since ancient times. It is found in many localities scattered over the globe, however, it is not found anywhere in the quantities that we would like. The orange red shade of this stone is pleasing to the eye of all races and the gem has universal appeal. Some specimens of carnelian from Bedford County are equal in quality to that from any place.

The cutting of carnelian presents no problems at all, just grind to a symmetrical shape and give it a good polish. The cabochon is the accepted manner for cutting this stone, however, most any pleasing shape will prove attractive. For the advanced lapidary, this is a good medium for carving into small figures. The carnelian is not plentiful in the area under discussion and the quality, quite often, is not the same throughout a given piece. The proper use of the saw is necessary in order to eliminate the poorest sections and to conserve the best material. In this connection, carnelian should be sawed approximately parallel to the bands. This is just the opposite to the iris agate mentioned above. You will notice that a little bit of color will go a long way. In a rough piece that shows only a small area of color, you will find that after being given a good polish, the small area of color will give the whole gem a good reddish glow. While everyone wants the real deep red material, it has been my experience that the lighter shades produce the more lively finished gems. When the depth of color reaches a certain intensity it seems to interfere with the light entering the gem and it will appear somewhat dead. We may control this factor by variation of the thickness of the gem. Where the material is deep in color it should be slabbed fairly thin and lighter pieces may be cut into thicker slabs.

For those who go into the faceting end of cutting, this material works up pretty nicely. I have seen some faceted stones of this carnelian that were very pretty. Before faceting this material some study of each piece should be made before actual cutting. In this material, there are usually

some turtleback planes which reflect the light with more or less fire and if improperly located will offset some facets and make the gem appear unsymmetrical. Otherwise, the stone may be faceted with pleasing results. Dipping the prospective piece in kerosene or other light oil makes it possible to look into the stone and by turning to various angles, under a good light, you may observe the interior make-up of the stone and proceed accordingly.

Here I think it is proper to mention the heat treating of this agate in order to produce a more intense red or carnelian shade. Some pieces of carnelian are found in this area which, in their natural state, are of a deep red shade, however, they are not plentiful. Those pieces which show a yellow or amber shade will take on a deeper shade of red or orange when heated up to about 500 degrees. The material that is naturally clear, gray or smoky will not show any change whatsoever after heating. The best means of heating this agate is an electric oven that may be closely controlled by a thermostat. I would recommend starting at 100 degrees and raising the temperature 50 degrees every hour or so until a temperature of 500 degrees is reached. The temperature should be lowered on the same scale of 50 degrees per hour until back to normal. If you do not have access to an oven of this type, then the oven of the kitchen range will do a fair job, however, it is not made tight enough to hold heat over a long period of time. Fair results may also be had by heating the stones in a pail of sand. Place about one inch of sand in the bottom of the pail then place the stones on this sand and pour in sufficient sand to completely cover the stones. Place the pail on a hot plate or range burner and heat slowly for several hours. The sand will heat up slowly and will cool slowly after the heat is turned off. Whatever system that is used, just make sure that the heating or cooling is not done too fast, otherwise the stones will crack. (See: Sinkankas, *Color Changes in Gemstones*, Lapidary Journal June and July 1963.)

I would guess that today more agate gem material is consumed in the tumbling process than for any other use, hence a few remarks on tumbling might be in order. As stated previously, this agate is very hard and dense and therefore will require a little more time in the grinding runs. This agate must be given a good polish in order to bring out its best features. The attractiveness of this agate depends on its effect on light rather than on color. For this reason a baroque with a dull finish will prove disappointing, however, when given a gleaming polish it will stand out in any batch of tumbled material. You will find lots of chips and small pieces in these fields and these along with fractured and flawed material may be used for tumbling, saving the larger solid chunks for sawing.

For those planning a visit to this area, the hotel and motel accommodations are quite adequate, however, there is one date that I should mention here. The National Walking Horse Celebration is held in Shelbyville each year. The date is usually the last week of August or the first week of September. The Tennessee walking horse was developed in this section and is bred in Bedford and surrounding counties. At this show the world's champion walking horse for the year is selected. ⊕



# THE CASTLE DOME FIRE AGATE FIELD

*By Oscar L. Brauer*

364 S. 16th St., San Jose, Calif.

On the eastern side of the Kofa Mountains in Yuma County, Arizona, a little north of the well-known Castle Dome seen from Highway 95, is a fire agate field known for several years as the Castle Dome Field. These areas were discovered and worked by Harold and Lillian Borgman, who live in California during the summer and winter at Castle Dome or Crystal Hill. So far as we know, these beds are on public lands except for the right of way for the pipe line of the El Paso Natural Gas Co., which is under private control. Only a four-wheel-drive vehicle or a rugged pick-up can reach the place. Otherwise it would probably have been exhausted by now. One cannot call the last few miles a road in the ordinary sense of the word, but it is more accurately designated as a jeep trail.

When you get there, however, there is a delightful camp ground. It is protected on three sides by quite high mountains. No wash of any size runs through the main camp, so there need be no fear of flash floods. Ordinary rains appear to be more abundant than in the surrounding desert as the saguaros, ocotillos, and palo verdes appear greener and more robust than is usually the case. Perhaps the mountains stop the clouds and chill them to precipitation.

At the Castle Dome Field two types of gems are much sought after, fire agates and sunbursts of quartz. These both occur in seams in rhyolite. The rhyolite is about as hard a rock as one can find. It is not very profitable to try to widen the seams in which the gems occur.

A very special type of tool is desirable when working in the Castle Dome Field. It consists of rods about one-fourth to



*Some of the quartz crystal clusters found at the Castle Dome Fire Agate Field.*

five-eighths inch in diameter with four inch hooks at both ends. The rods vary from four feet to eight feet long. One home-made tool is quite handy. This consists of a small tin can nailed crosswise on the end of a long stick such as a broom handle. With this one can reach down into a seam and scoop up the dirt in

which the agates usually occur. Some sunbursts occur in this dirt also. Other agates and sunbursts are clinging to the walls. In this case the hooked rod is used to pull them off. Fortunately most of the sunbursts are attached to the wall at only one small spot and will pull off without injury to the design.



*The east and west halves of the Castle Dome Fire Agate Field, looking north. West is of course at your left here. These are two separate photographs that have been merged into one panoramic scene.*





*Much of the beauty of a rockhounding trip lies in the pleasure the lovely scenery encountered brings. This scene shows a view of the mountains back of the Castle Dome Fire Agate Field, looking west.*

The Castle Dome camp is strictly a dry camp. Water must be taken in for the entire time you plan to stay.

Now that you have a four-wheel-drive or a pick-up that does not set too low, and a couple of five gallon cans of water, your next question is how do you get there?

Let us start from Quartzsite on Highway 60-70. Go south on Highway 95 towards Yuma. The Kofa Mountains on your left are wonderously rugged. If clouds happen to be above them you have a chance for a salon picture. Twenty-seven miles down the Highway you see a restaurant and service station on the right called Stone Cabin. About one-fourth mile before you reach Stone Cabin a well-graded dirt road takes off a little south of east. Go 6.4 miles on this road. It takes you through a gap in the mountains into the edge of a large valley. The well-graded road you are on goes across the valley to some mines. The mountains which surround this valley are very rugged and spectacular. Just as you get into the valley a track (usually well-worn) takes off south into the raw desert. It is a winding road and pretty rugged, although not nearly so rugged as the last section of the trip. This part of the road lasts 4.3 miles and swings around to the Old Yuma Road, which is now almost obliterated.

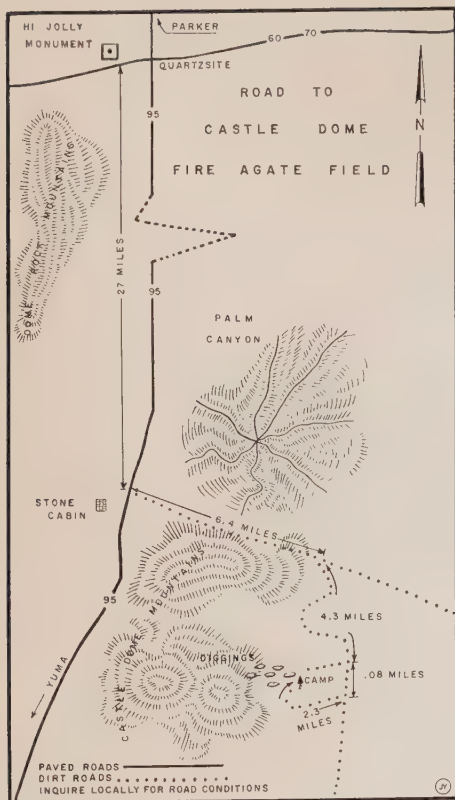
At the end of the 4.3 miles a well-worn track takes off to the right. It comes in back of the fire agate diggings, but does not go to the camping spot. However,

it does come within walking distance of the diggings, so if one had only a stock car he might get in this far and walk to the agate field.



*The camp at Castle Dome showing Mr. and Mrs. R. E. Brauer of Trinidad, California and Mr. Fred Bentley of San Jose, Calif.*





Do not turn right on this track but continue south for eight-tenths of a mile more. Here the main track turns right. The old Yuma road continues on, but it is so dim you might not notice it. Now you are on the jeep trail which continues two and three-tenths miles on to the camp. This track goes up a wash and around a mountain that forms an island in the wash. After going around the mountain the road doubles back on the north side of the wash somewhat in the form of a fish hook.

Now you are in camp you will soon be ready for hard work. Hard work, however doesn't worry a rockhound. During the winter there averages about five camps here. Most of the campers at the Castle Dome Field have their long term headquarters at Crystal Hill. ⊕



## UNIQUE AGATES FOUND BY E. N. SMITH

Illustrated here are a beautiful brooch with a bow pin in which a piece of Mexican lace agate has been made into a cabochon and shows a very distinct letter "L." This picture and the accompanying one showing a very fine "fisheye" also from Mexican agate were sent to us by Mr. E. N. Smith of Geode Industries of 106 W. Main, New London, Iowa. ⊕

## SOLIDLY FILLED AGATIZED CORAL FOUND IN NEW FLORIDA LOCATION

By Herman W. Hollingsworth

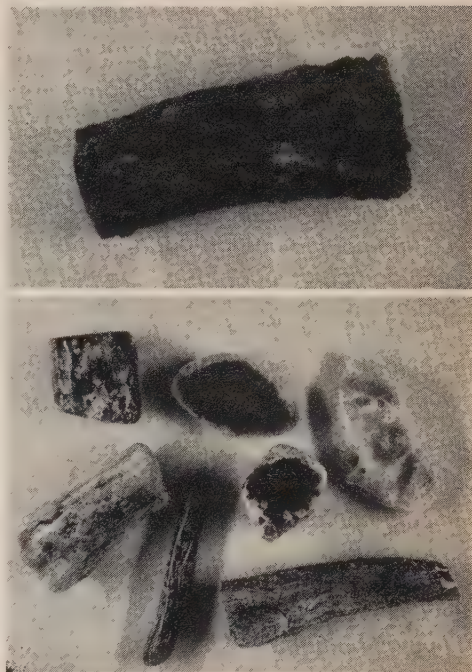
P.O. Box 338, Mango, Florida

I recently found an outcrop of Miocene age agatized and opalized coral that brings to three the number of locations of such material to be found here in Florida. The Tampa Bay deposits at Ballast Point, of course, are well-known, and the beaches at Venice, Fla. are well-known for the shark teeth and bones to be found there.

This agatized and opalized coral I have found is more solidly filled in than are the geodes of Ballast Point, which are practically all hollow. At first I thought this new material to be wood, but the State Geologist's Office says that it is coral with some oyster shell.

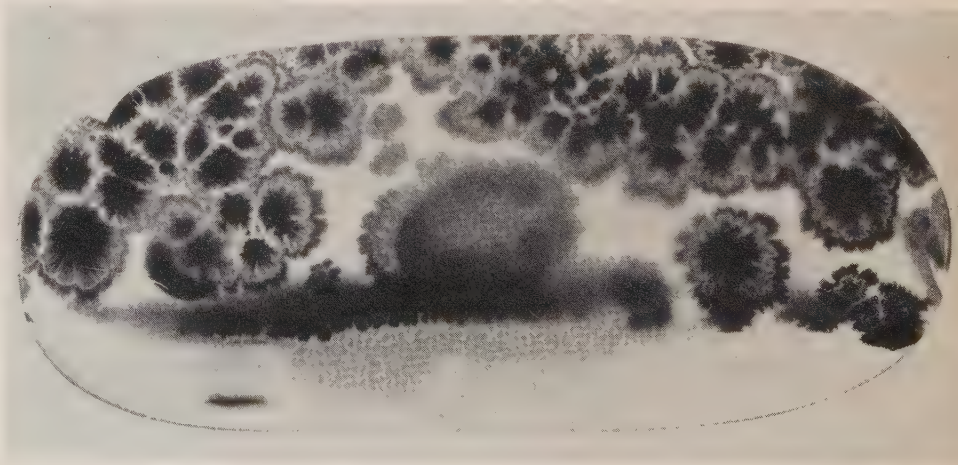
The location of the material is in an undisclosed orange grove, and the owner has given me permission to gather as much as I want; however, he does not want the location made public for the reason that he is not at home very much and does not wish unwarranted intrusion upon his property without his permission. Not too far away is the location of an old Indian village where the digging has been done so shamelessly and the holes made left unfilled, to the extent that the property owner has now barred all such digging, and even had to use a bulldozer to fill up some of the holes left by the diggers.

I also know of some red flint that cannot be taken because of another fellow's unconcern about the manner in which he did his digging. Not long ago I was asked to go with one man to prospect. I got to his home at 7 A.M. and was told that he had left without me, as he didn't expect me to be there. Since 7 A.M. isn't exactly late in the morning, I asked his wife what time he had left for the trip and she said "A little before daylight, as digging had to be done early as the owner



would "chase you after he got up . . ." Needless to say, I won't ever go prospecting with this man.

The new material I have found is mostly pink and solid, with some white pores of the coral showing, and looks for all the world like stag-horn. The broken segments vary all the size from about one inch down to slender pieces of  $\frac{1}{2}$  to  $\frac{1}{4}$  inch in thickness. It cuts and polishes well, and slices right across the piece, left with the natural rind on them, are quite attractive for use as cuff-links or earrings when polished. The more irregular pieces take well to tumbling and come out as shining free-forms of coral. ⊕



## FINE MONTANA DENDRITIC AGATE

The beautiful example of Montana dendritic agate shown here was found in the summer of 1961 near Miles City by W. A. Burt of 6015 N.E. Skidmore St., Portland 18, Oregon, a charter subscriber to the Lapidary Journal, whose shop was shown in an article in the August, 1959 Lapidary Journal. This is only one of a great many fine Montana and other agate cabochons in the superfine collection Mr. and Mrs. Burt have accumulated by years of travel and cutting. ⊕

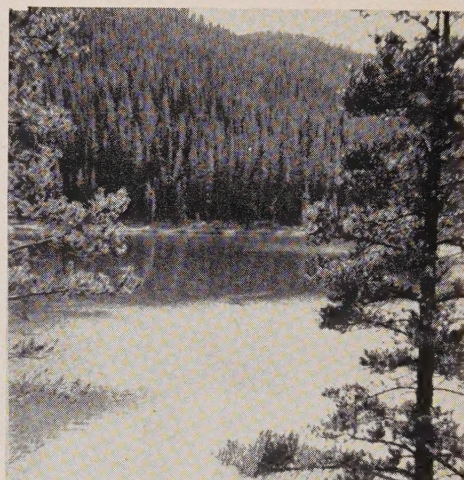
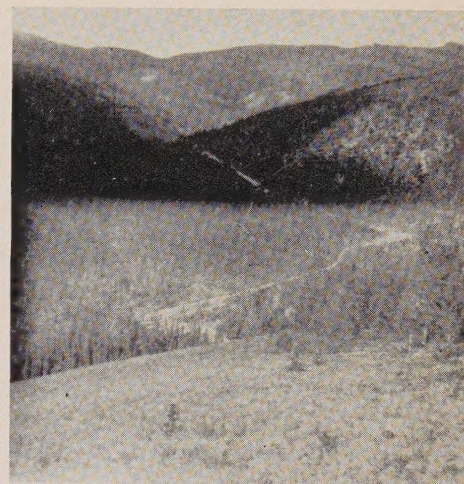
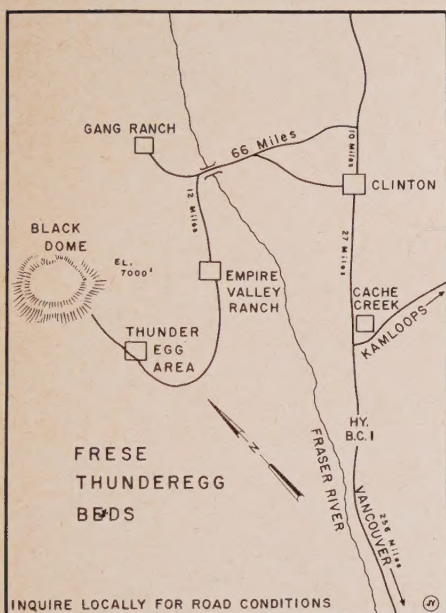
**HAVE YOU SEEN GEM CUTTING  
SHOP HELPS — ASK YOUR DEALER**



# NEW FIND OF AGATE THUNDER-EGGS MADE

*In British  
Columbia*

*By  
Mrs. Fred Frese*



*British Columbia Thunder-Egg Country*

1. *Black Dome Mtn. taken from an elevation of 5,500 feet and a distance of about 3 miles.*
2. *A portion of the 26-mile road built by the Freses, leading to Lone Cabin Creek, and agate filled thunder-egg location.*
3. *A pack train ready to leave for Frese's camp.*
4. *Rockhounds are often fishermen, too—this lake is alongside the road in to Lone Cabin Creek.*

Agate thunder-eggs by the ton, concealed under volcanic detritus, perlite and obsidian, were discovered near a new road built by Fred Frese and his son to reach their new hunting and fishing lodge in a remote area of British Columbia. The find is located about three miles from "Black Dome," the remains of an extinct volcano which is about 60 miles from Clinton as the crow flies in a northwesterly direction, but about 100 miles by road.

The new location is accessible by road from May through September, and is behind a private cattle ranch. Particulars on getting access to the area can be had by writing to Fred Frese, Empire Valley, Clinton, B.C.

During the summer of 1960, Mr. Frese and his son discovered the thunder-egg beds in the process of building twenty-six miles of road into a location where they are building a hunting and fishing lodge. It is all rough country and ranges in elevation from about 2,500 feet at the Fraser River crossing

to about 7,000 feet at the top of Black Dome. The country changes from almost desert-like along the river, to high timberland and mountain meadows.

The thunder-eggs contain many colors of agate, from clear to amber, green and orange, and occur with banding in some and fortification patterns in others. Some have crystal centers, and some have combinations of agate and crystal in the same thunder-egg. Thousands of them have been cut, in various sizes from one half inch to seven and eight inches in diameter, and all seem to have agate or crystals or combinations of both in their

centers. The color of the matrix varies somewhat from egg to egg.

There are other gem materials to be found by the rockhound in the area, among them mainly jaspers of many colors including a beautiful blue orbicular jasper. Quartz of various colors abounds. It is probable that the one area of about 40 acres that Mr. Frese uncovered is only one of several beds in the area, as the situation is favorable for the formation of agates. So far as is known, this is one of the few deposits of thunder-eggs in the British Columbia area.













\* 05-PJE-456 \*