

THE ROBERT A. HAAG COLLECTION

**ALL NEW FIELD GUIDE  
AND  
CATALOG OF METEORITES**

*Keep!*

THE ROBERT A. HAAG COLLECTION

# FIELD GUIDE AND CATALOG OF METEORITES

SPECIAL EDITION — VOL. 10

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Cover: A commissioned oil painting by Kim Poor, 1983, showing a meteorite exploding upon entry into the earth's atmosphere.



**THIS IS THE ALL NEW**  
**ROBERT A. HAAG CATALOG OF METEORITES**  
**VOLUME 10**

This catalog is designed to fulfill many purposes. It's a price list of what new meteorites are available, along with an introduction into meteorites 101 and a field guide to recognizing meteorites apart from ordinary earth rocks. I am always keeping my eyes open, scanning the rocks and stones around me. You never know, you could even find a meteorite if you're lucky. Well, it's not all luck, you have to look!

Hello! I am Robert A. Haag, The Meteorite Man. I buy, sell, trade, hunt, and deal in meteorites for a living. This business takes me all over the world and all around the solar system. I love my work. The idea of finding and studying something that was once a star, or asteroid from the unknown and unexplored regions of deep space is exciting to me. It's a great job. I can be a space man here on earth and so can you!

Unfortunately, less than one in one thousand people out there would know a rare stone meteorite from an ordinary earth rock. In back yards, fields, vacant lots and alleyways around the world are millions of rare and exotic stones from space, just lying around waiting to be discovered. The purpose of this catalog is to help you understand the difference between meteorites and ordinary earth rocks. Pictured here are over 100 different types of meteorites, representing the three main groups - Stones, Irons, and Stony Irons. All known meteorites in the worlds' collections fit into one of these categories. Let's take a look at what meteorites really are.

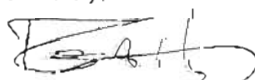
Meteorites start their life in what scientists call "parent bodies". This can be an asteroid, a large moon, comet, or even a star. Since these parent bodies formed out of the dust of a forming solar system, each has had a different geological history. Some joined together to form planets, some were consumed by the sun, others made moons, and some just "hung out" in the outer edges of the solar system to remain unchanged since their formation. Those meteorites are related to comets and are similar in composition to the sun. They are some of the most exotic and valuable types known, called "carbonaceous chondrites". I'll get into that later. The other parent bodies, asteroids, moons, planets, etc., all had enough size to physically start changing this space dust. As the parent bodies grew, underlying materials began to melt and mix. The larger the parent body, the more pressure and temperature to change the material. In school you learned that the earth has a molten iron and nickel core. This makes up most of the earth's mass. Our moon, however, also has an iron nickel core except it is no longer molten. It cooled and crystallized about 3 billion years ago. Most of the small moons and asteroids out there did the same thing. In time, some of these moons collided with each other, smashing and mixing. Some reformed, others barely touched. There are basic things you find in 99% of all meteorites, pure crystallized iron or pieces of it mixed up with silicate stone material. That's the main idea. Mixed up a little or mixed up a lot. There are huge iron "chunks" and huge stone chunks and there are huge stony/iron chunks. That's what falls to earth as a shooting star. If it's a big piece, it's called a bolide or fireball.

When these space rocks enter the atmosphere they hit at super high speeds and blow apart. Most burn up completely. The softer stone meteors just turn to dust and maybe a few tiny pieces will actually land on the ground. Iron pieces come in and are physically stronger so they survive with less damage. The speed of a fireball, angle of entry, mass, and makeup of the meteor determines how much of it survives. What survives will show a melted skin or fusion crust. Depending on where it lands and how long this space rock sits on the ground determines how long it's going to last here. Ground water, humidity, blowing sand and ice, even farmers' plows all will weather away the meteorite. What mostly happens is they start to rust. That iron stone mixture now has to deal with water and it's never been exposed to it. There is one exception - stone meteorites, carbonaceous chondrites. There's that word again. Some have visible metal and some don't. But all still contain iron. A simple magnet is a good test. See if there is an attraction.

Back to the rust or weathering. The photos in this catalog show many different stages of this process. Learning to recognize meteorites begins with just-fallen stones to weathered piles of rusty looking rocks. All are worth money and valuable to Science. Believe me, you could find a meteorite that has never been seen on earth before! I have a collector network of thousands of interested buyers. There are private collectors, schools, museums, research labs, etc., all wanting good meteorite specimens. Through the free enterprise system I can sell you a meteorite from a few dollars to a complete collection for thousands. Big or small, some meteorites have beautiful gemstones (peridot). Others have tiny diamonds formed before ours existed. But the true treasures are what scientists can learn from rare meteorites. You never know what you might find.

Good luck hunting or starting a collection. I hope this catalog of meteorites can help. All meteorites are named after the closest town or landmark where they were found. Sizes are in metric (2.5 cm = 1 inch, 454 grams = 1 pound.)

Sincerely,



Robert A. Haag

P.S., I will buy any meteorite you can find. Let's deal!

**ROBERT A. HAAG METEORITES, P.O. BOX 27527, TUCSON, AZ 85726 USA**  
**TELEPHONE (602) 882-8804      FAX 1-602-889-0551**



# IRON METEORITES

1



CANYON DIABLO, ARIZONA USA

COARSE OCTAHEDRITE 1A, 100 kg. LARGE BOWL-SHAPED SPECIMEN FROM ARIZONA'S METEORITE CRATER NEAR FLAGSTAFF.

2



HENBURY, CENTRAL AUSTRALIA

MEDIUM OCTAHEDRITE 111A, 30 kg. PERFECTLY ORIENTED SPECIMEN SHOWS EXCELLENT SURFACE PITTING AND "THUMB PRINTS" DUE TO HIGH SPEED ABLATION DURING ENTRY.

3



CAMPO DEL CIELO, ARGENTINA

COARSE OCTAHEDRITE 1A, 62 kg. THIS SPECIMEN HAS BEEN WIRE POLISHED CLEAN TO REMOVE A THICK OXIDE SHELL REVEALING AN EXCELLENT PITTED SURFACE INSIDE.

4



SIKHOTE-ALIN, USSR

COARSEST OCTAHEDRITE 11B, 755 grams. THIS SPECIMEN IS PART OF THE LARGEST METEORITE FALL IN RECENT HISTORY TOTALLING OVER 23,000 kg. NOTE JAGGED TWISTED SHAPE.

5



MUNDRABILLA, WEST AUSTRALIA

MEDIUM OCTAHEDRITE, (IRANOM) 70 kg. THIS VERY UNUSUAL METEORITE IS COVERED WITH DIME-SIZED HOLES - WEATHERED OUT IN TIME. FOUND ON THE NULLARBOR PLAIN.

6



GRAPHITE NODULE, CANYON DIABLO, AZ USA

1 kg. THIS IS AN END PIECE OF A GRAPHITE NODULE FOUND NEAR METEORITE CRATER, AZ. NOTE THE NETWORK OF METAL IN THE GRAPHITE.

7



GIBEON, NAMIBIA

FINE OCTAHEDRITE, IVA IRON, 220 kg. SPECIMEN. NOTE FLATTENED AREA ON TOP OF THE SPECIMEN, DUE TO THE COLLISION OF PIECES AS IT BROKE UP COMING THROUGH EARTH'S ATMOSPHERE.

8



TOLUCA, MEXICO

COARSE OCTAHEDRITE 1A IRON, 3 kg. TYPICAL WEATHERED IRON METEORITE. PEOPLE MADE TOOLS FROM THIS LOCAL SPACE METAL.

9



BOXHOLE, AUSTRALIA

MEDIUM OCTAHEDRITE 111A, 4kg. THIS SPECIMEN WAS RECENTLY FOUND NEAR THE CRATER USING A METAL DETECTOR AT A DEPTH OF ABOUT 30 cm. FOUND ALMOST 1 km. FROM THE CRATER.



AEDAMA, MEXICO

MEDIUM OCTAHEDRITE, NEW IRON 111AB, 7.2 kg. RECRYSTALLIZED. THIS PIECE SHOWS NICE FLIGHT MARKINGS.

11



ATACAMA DESERT, N. CHILE

N. CHILEAN HEXAHEDRITE 111A, 4.7 kg. & 17.2 kg. WHEN ETCHED, HEXAHEDRITES SHOW NEWMAN LINES. NOTE THE PITTED SURFACE FROM THE BLOWING SANDS OF THE ATACAMA DESERT.

12



SANTA CLARA, MEXICO

NICKEL RICH ATAXITE 1VB, 1107 grams. ARE DIFFICULT TO RECOGNIZE. THEY SHOW NO PATTERN WHEN ETCHED.



**#1. Canyon Diablo, Arizona USA (35x35x20 cm).** This is the same as The Arizona Meteorite Crater, near Flagstaff, Arizona. It is one of the most popular and common meteorite specimens around. I found this piece in Berlin, West Germany and brought it all the way back to Arizona, where it originally fell.

**#2. Henbury, Central Australia (25x25x15 cm).** This piece shows very good orientation. Orientation means that as the rock was flying through the atmosphere, it kept a stable flight and did not tumble. Melting material was ablated or swept back from the apex (the center). You can see that it has a nice patina of rust and little bits of the fusion crust. This is our most popular medium octahedrite.

**#3. Campo Del Cielo, Argentina (35x35x20 cm).** This iron shows good thumb printing. It has a typical pitted surface. This specimen has been wire brushed clean to remove a very thick layer of oxide. It's estimated to have fallen about 5 thousand years ago. Sometimes available. Write to me for this one.

**#4. Sikhote-Alin, Russia (13x7x20 cm).** This is a Russian fall, one of the largest in recorded history. The fragments are jagged and twisted. When this iron fell it went off like a grenade. Scientists even found some fragments stuck in trees. This is a place I would love to hunt with my metal detector. I'm working on it.

**#5. Mundrabilla, West Australia (35x20x20 cm).** This is a very unusual meteorite. It's anomalous, which means there's not another meteorite like it. Mundrabilla specimens have lots of holes which is very unusual for a meteorite. This is because a softer, sulphide material melted and weathered out faster than the crystallized iron. You'll see a sliced example of this later, #18.

**#6. Graphite Nodule, Canyon Diablo, Arizona USA (11x8x3 cm).** This is an example of an inclusion of graphite, shocked with metal from the impact blast of the meteorite. It's probably been in the ground 50 thousand years. Either the metal around it weathered away or was blasted away by the impact explosion.

**#7. Gibeon, Namibia (58x33x28 cm).** This is a new specimen of Gibeon which weighs roughly 500 pounds. The top of it looks completely smashed. An iron asteroid broke up into pieces while coming through the atmosphere. As this meteorite was disintegrating it evidently smashed into another piece so there was an impact. That squashed area then got ablated itself. This definitely did not occur on earth because it has been here too many years.

**#8 Toluca, Mexico (23x13x7.5 cm).** The actual location is called Xiquipilco. It's high in the mountains near Mexico City at almost 6000 feet elevation. Local people grow corn there. While they are farming they occasionally find these heavy iron rocks. Some were made into tools and farm implements. Xiquipilco is a magical place. I have hunted there before.

**#9. Boxhole, Australia (23x5x5 cm).** A medium octahedrite, very similar to Henbury. When the asteroid fell it produced a small crater. A few large masses were found nearby, as well as shale balls which are weathered-out iron meteorites.

**#10. Aldama, Mexico (35x13x10 cm).** What's unusual about this specimen is that it went through some kind of an extended heating process before landing on earth. It appears that the Widmanstätten pattern is somewhat recrystallized. This takes a long period of time at over a thousand degrees. Whether that heating was due to a collision of the parent body or whether the asteroid went close to the sun for an extended period of time is unknown. It was not hot enough to melt away the crystal pattern. Notice the fusion crust and nice thumb printing behind the leading edge.

**#11. North Chilean Hexahedrite (smaller EP 23x8x7 cm), (larger EP 23x15x10 cm).** This type of iron meteorite is called a hexahedrite. It's different from the octahedrites. It has a low nickel 5-6% and is made of Kamacite. This one laid around the desert of North Chile for thousands of years and has thus been naturally sandblasted. Although it's been etched, a Widmanstätten pattern does not appear. However, it shows another type of etch called Newman lines. Hexahedrites have less nickel than octahedrites and ataxites have the most nickel of all irons.

**#12. Santa Clara, Mexico Ataxite (18x13x1 cm).** This has neither a hexahedrite nor an octahedrite pattern. It's called an ataxite and is the most nickel rich of all irons, usually 16% or more. It's one of the most difficult irons to distinguish from earth irons. Note the lack of inclusions inside this meteorite.



*Space trader, Robert Haag, with a piece of Skylab that was recovered in Perth, West Australia.*



# IRON METEORITES

13



TWANNBURG, SWITZERLAND

NEW IRON, 430 grams. UNGROUPED. NOTE UNUSUAL SNAKE-LIKE CRYSTALS OF SCHREIBERITE.

14



ODESSA, TEXAS

COARSE OCTAHEDRITE 1A, 2 kg. THIS ETCHED END PIECE IS FULL OF TYPICAL INCLUSIONS WITHIN IRON METEORITES. COARSE WIDMANSTATTEN PATTERN IS CLEARLY VISIBLE.

15



TOLUCA, MEXICO

COARSE OCTAHEDRITE 1A, 2,930 grams. ETCHED SLICE OFF A 75 kg SPECIMEN. VERY GOOD WIDMANSTATTEN PATTERN AND SEVERAL GRAPHITE AND TROLITE INCLUSIONS CAN BE SEEN.

16



ARISPE, MEXICO

COARSE OCTAHEDRITE 1C, 348 grams. ONE ARISPE SPECIMEN WAS FOUND BEING USED AS AN ANVIL IN THE NEARBY TOWN.

17



MAGURA, CZECHOSLOVAKIA

COARSE OCTAHEDRITE, 1A IRON, 748 grams. MOST OF THIS METEORITE WAS SMELTED INTO FARM IMPLEMENTS IN THE 1800s.

18



MUNDRABILLA, WEST AUSTRALIA

MEDIUM OCTAHEDRITE (IRANOM) 1569 gram SLICE. VERY UNUSUAL STRUCTURE. SILICATES AND SULPHIDES MIXED UNLIKE ANY OTHER METEORITE. SEE CATALOG VOL. 6. COMPARE SPECIMEN.

19



CAPE YORK, GREENLAND

MEDIUM OCTAHEDRITE, IIIA IRON, 1218 grams. DISCOVERED BY ESKIMOS AND USED AS THE ONLY SOURCE OF IRON FOR SPEAR POINTS. THE LARGEST IS NOW IN NEW YORK MUSEUM OF NATURAL HISTORY.

20



KENTON, KENTUCKY USA

MEDIUM OCTAHEDRITE, IIIA IRON, 205 grams. TWO SPECIMENS WERE FOUND SEVERAL MILES APART WHILE FARMING.

21



SACRAMENTO MOUNTAINS, NEW MEXICO USA

MEDIUM OCTAHEDRITE, IIIA IRON, 887 grams. A MASS OF OVER 500 LBS. WAS FOUND BY RANCHERS.

22



GIBEON, NAMIBIA AFRICA

FINE OCTAHEDRITE, IVA 2,497 grams. THIS SPECIMEN HAS BEEN CUT AND POLISHED, THEN ETCHED TO REVEAL A UNIQUE FINE WIDMANSTATTEN PATTERN.

23



ALVORD, IOWA USA

FINE OCTAHEDRITE, IVA IRON, 81 grams. NOTE HOW THE WIDMANSTATTEN PATTERN HAS BEEN DEFORMED ON ONE SIDE.

24



ODESSA, TEXAS USA

METEORITE KNIFE BLADE, DAMASCUS STEEL PATTERN. THIS BLADE WAS FOLDED SEVERAL HUNDRED TIMES. HANDMADE BY TOM McLANE.



**#13. Twannburg, Switzerland (18x10x1 cm).** This meteorite has inclusions of phosphorus which make schreibersite crystals. These crystals are not found in ordinary earth rocks. Twannburg is an anomalous iron, currently ungrouped.

Here are some examples of **coarse octahedrites**. If you cut an octahedrite iron meteorite, polish out the saw marks and grind down to where it's only 2-300 grit scratches, you can etch it in a diluted nitric acid solution. I use 10%. Octahedrites will show the crystal boundaries of two different iron nickel minerals, Kamacite and Taenite.

**#14. Odessa, Texas USA (18x13x1 cm).** Odessa, Texas is a coarse octahedrite. Coarse means it has the largest crystal size. Octahedrites can be coarse, medium or fine, depending on the amount of nickel present, 7-12%.

**#15. Toluca, Mexico (28x18x1 cm).** There are round nodules of trolite (FeS) and graphite mixed with the crystallized iron. The Toluca meteorite has a very nice etched pattern. Corum of Geneva, Switzerland currently makes a very expensive watch using this meteorite, priced around \$5,000.

**#16. Arispe, Sonora, Mexico (14.5x7x1 cm).** This is also a coarse octahedrite. This slice is almost free of inclusions. Note how obvious the crystal boundaries are. The meteorite recovery team is currently hunting this location in Mexico.

**#17. Magura, Czechoslovakia (9x4.5x4 cm).** The inclusions in this specimen are tiny crystals of schreibersite. Most of this meteorite was smelted down into farm tools.

**#18. Mundrabilla, West Australia (23x18x1 cm).** You can see ribbons of trolite inclusions (iron sulfide) in this slice. This is a very unusual pattern and will weather out easily making holes in the meteorite.

**#19. Cape York, Greenland (19x13x.5 cm).** These meteorites were discovered by Eskimos who named them "The Tent, The Woman, and The Dog". They showed them to Admiral Perry around the turn of the century who brought them back to New York for public display. Another specimen was found recently at low tide in the ocean! The Tent is the largest iron meteorite "in captivity" and is on exhibit in New York's Museum of Natural History. Notice the smaller medium octahedrite pattern and trolite inclusions.

**#20. Kenton, Kentucky USA (9.5x5x1 cm).** Medium octahedrites are more nickel rich than coarse octahedrites, therefore they have smaller crystals.

**#21 Sacramento Mountains, New Mexico USA (13.5x10x1 cm).** This iron meteorite has a nice medium etched pattern and a brassy colored trolite nodule. This was a museum trade.

**#22. Gibeon, Africa (4x3x1 cm).** This etched slice has a fine octahedrite pattern. The slices are absolutely beautiful. The Massi warriors made spear points from this iron in Africa since it was the only metal known to them. It's a very malleable metal and resists rusting. This meteorite is perfect for jewelry.

I have visited this location. After talking to the headmaster of the local public school, he assembled approximately 400 students. I spoke to them about iron meteorites and showed them some samples, which each of them held. Within a few weeks, six specimens were recovered and brought into the school by the students. I purchased all that they had found. That's the way to find meteorites!

**#23. Alvord, Iowa USA (9x5x25 cm).** This also has a fine octahedrite pattern. There has been some kind of disruption of the pattern on the upper half of the left edge. This was caused by either a collision of the main body while still in space as it blew apart, or while coming through the atmosphere. Some kind of torque altered the fine pattern.

**#24.** This is a knife blade made out of meteorite material from Canyon Diablo, Arizona. I supply meteorite materials for many unusual projects. I sold the American Buddhists League meteorite material to make a ceremonial knife. In ancient times, it was believed that these knives were the only way to kill demons. (23x2.5x2 cm).



*On location at the Millbillillie, Australia strewnfield. The sandy soil makes the meteorites easy to spot.*



# SILICATED IRONS - MESOSIDERITES

25



ODESSA, TEXAS USA

CLOSE-UP PHOTOGRAPH OF AN ODESSA INCLUSION MADE UP OF GRAPHITE, TROLITE AND RIM OF SCHREIBNERITE. NOTE A SINGLE SILICATE OLIVINE INCLUSION.

26



UDEI STATION, NIGERIA

COARSE OCTAHEDRITE, CUT FRAGMENT SILICATED IRON 855 grams. CLOSE-UP OF FUSION CRUST. A NEW FALLEN, WELL-PRESERVED IRON.

27



WOODBINE, ILLINOIS USA

ANOMALOUS, SILICATED IRON, 471 grams. ONE MASS WAS FOUND WHILE PLOWING.

28



TOLUCA "B", MEXICO

943 grams. A NEW SILICATED IRON WAS DISCOVERED AMONG OTHER COLLECTED IRONS FROM THE ORIGINAL TOLUCA STREWNFIELD.

29



MOROCCAN IRON, MEW

SILICATED IRON 1A, 550 grams. A NEW STREWNFIELD WAS ACCIDENTALLY DISCOVERED WHILE HUNTING FOSSILS. EXACT LOCATION IS UNKNOWN.

30



LANDES, WEST VIRGINIA USA

SILICATED IRON 1A, 206 grams. THIS SLICE IS COMPLETELY FULL OF PYROXENE CRYSTAL (SILICATES). THEY APPEAR TO GROW INSIDE THE MATRIX OF IRON VS. MESOSIDERITES.

31



CADDO CO., OKLAHOMA USA

SILICATE RICH IRON 1A, 17 kg. A VERY UNIQUE NEW METEORITE FOUND BY HASKEL SMITH. INCOMPLETE MIXING OF THE SILICATE AND THE METAL. COMPARE THIS TO THE LANDES AND THE NEW MOROCCAN.

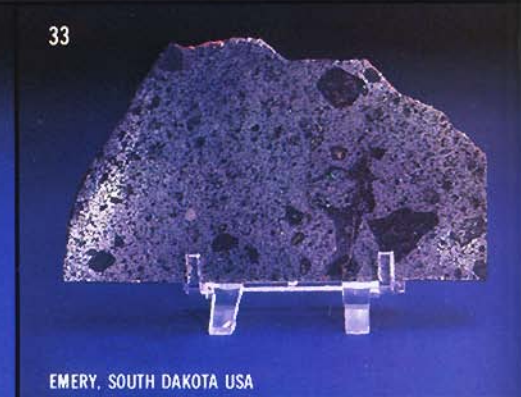
32



ESTERVILLE, IOWA USA

STONY IRON MESOSIDERITE, FELL MAY 10, 1879. 818 grams. END PIECE. THE METAL AND SILICATE PORTIONS OF THIS METEORITE ARE JUST SLIGHTLY MIXED TOGETHER. COMPARE THIS TO EMERY.

33



EMERY, SOUTH DAKOTA USA

STONY IRON MESOSIDERITE, 211 gram SLICE. THE METAL AND SILICATES HAVE BEEN BROKEN AND SMASHED TOGETHER. MIXED DUE TO COLLISIONS IN SPACE.

34



CRAB ORCHARD, TENNESSEE USA

MESOSIDERITE, 181 grams. NOTE LARGE CHUNKS OF STONE & METAL.

35



MINCY, MISSOURI USA

MESOSIDERITE, 224 grams. A MASS OF 197 LBS. WAS SEEN TO FALL IN 1857. INCOMPLETE MIXING OF STONE & IRON.

36



CHINGUETTI, MAURITANIA

MESOSIDERITE, 264 gram SLICE. NOTE HOW THE METAL AND SILICATES HAVE BEEN FOLDED INTO OTHER.



**#25. Odessa, Texas USA (image area 4x2 cm).** This is an inclusion from an Odessa, Texas iron meteorite. You've got schreibersite as a rim around the outside. Mixed together inside is dark black graphite (carbon) and trolite, a brassy color. Also showing is a bright yellow crystal of olivine. Olivine is a silicate material. When certain percentages of silicates are present in octahedrites they are called silicated irons.

**#26. Udel Station, Nigeria (10x8x4 cm).** Here's a slice that I got in Nigeria off the Main Mass through trade. You can see some of the silicate areas inside. Fresh fusion crust is clearly visible on the outside of this iron. It is a recent well-preserved witnessed fall, and was dug up from the impact hole.

**#27. Woodbine, Illinois USA (11x11x1 cm).** The silicates are very obvious in this iron. It's very unusual anomalous 1B silicated iron with a fine octahedrite pattern.

**#28. Toluca "B", Mexico (11x11x3 cm).** Inside the Toluca, Mexico strewnfield they find the Toluca irons, see #8. The locals are hip and know about meteorites. They get good money for them. Through their efforts another new silicated iron meteorite was picked up. It was half as heavy but obviously another iron meteorite. I noticed this piece immediately and bought it outright.

**#29. Moroccan Silicated Iron (17x10x7 cm).** Now called Zagora. Found in the desert while hunting fossils near the Atlas Mountains. There are so many inculsions of silicates that it disrupts the etched, medium octahedrite pattern. This was found near a military zone and I have been trying unsuccessfully to get more of this material. If only I could get in there with my metal detector!

**#30. Landes, West Virginia USA (10x9x1 cm).** This is a very beautiful, unusual meteorite with so many silicates that the crystals of pyroxene definitely seem to grow inside this iron, unlike a mesosiderite where it's blended together.

**#31. Caddo County, Oklahoma USA (28x15x8 cm).** Another silicated iron. When I first received samples of this new find, it was a sample of just the silicated portions. Then another friend told me he had received an iron section off of it. I got the finder to bring it to Tucson and I bought half of the specimen. The big areas of stone and iron are poorly mixed together, sort of a borderline mesosiderite/silicated iron. This is closely related to lodranites.

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Now we're going to start on another group, stony irons. This includes pallasites and mesosiderites. Mesosiderites are usually 50% iron and 50% silicates and some trolite. The silicates are mainly hypersthene and plagioclase.

**#32. Esterville, Iowa USA (10x7x5.5 cm).** The iron and stone portions are poorly mixed together. This was a witnessed fall in Iowa in 1879. The fireball blew up into thousands of little pieces and landed in the fields below. I've searched this farmland. It was very well picked over. It was worth a mint when it fell.

**#33. Emery, South Dakota USA (15x8x.5 cm).** The iron and stone portions are very well mixed. It's been completely smashed together. During its formation, there was some kind of grinding or boundary zone, or a lot of folding over of the material in its early history. Remember meteorites going through the atmosphere are frozen, solid chunks and only break into smaller pieces. This is the way it formed in space and the way it will look when it lands on earth. The meteorite material did not change while going through the atmosphere with the exception of a melted skin or crust.

**#34. Crab Orchard, Tennessee USA (6x5x2 cm).** Look at the big clasts of stone and iron metal. Some pieces are larger than others.

**#35. Mincy, Missouri USA (9x7x1 cm).** Here's another example of a boundary area. Large stony chunks are mixed into this mesosiderite. More specimens of this meteorite would be welcome. I have an instant market.

**#36. Chinguetti, Mauritania (9x4.5x1 cm).** One of the largest meteorites found, and now lost, in the Sahara Desert. It's kind of a lost Dutchman. Only one small piece was brought in 150 years ago by a Bedouin. One man who knew the location was allegedly poisoned because he divulged the secret to a European. It's never been re-found, remaining lost somewhere in the desert of Mauritania. A mesosiderite estimated to weigh over one million kilos is still thought to exist.

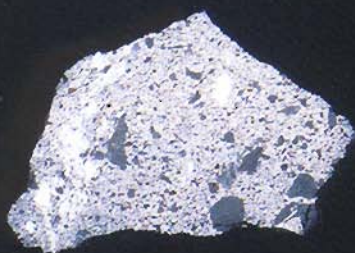


*A 125-lb. iron meteorite just blasted out of the rocks.*



# STONY-IRON METEORITES- PALLASITES AND MESOSIDERITES

37



CLOVER SPRINGS, ARIZONA USA

MESOSIDERITE, 90 gram SLICE. A FRESH 7 kg. SPECIMEN WAS FOUND NEAR A RANCHER'S STOCK TANK IN 1954.

38



MOUNT PADBURY, AUSTRALIA

MESOSIDERITE, 564 gram END PIECE. THIS WAS VERY DIFFICULT TO RECOGNIZE AS A METEORITE UNTIL A PIECE WAS CUT OPEN. METAL, METAL EVERYWHERE!

39



MT. EGARTON, W. AUSTRALIA

ANAOLAMOUS MESOSIDERITE, 52 grams. LARGE CRYSTALS OF ENSTITITE (MgSi) ARE POORLY MIXED AMONG SMALL IRON PIECES. MOST OF THE IRON WEATHERED AWAY.



CHILE

PALLASITE, STONY IRON 200 grams. A THIN SLICE LIT FROM BEHIND. OLIVINE CRYSTALS SET IN METAL IRON NETWORK.

41



OTINAPA, DURANGO MEXICO

PALLASITE, STONY IRON, 5.6 kg. A NEW FIND DISCOVERED WHILE FARMING. VERY LITTLE WEATHERING OF THE IRON SUGGESTS IT MAY BE A RECENT FALL.

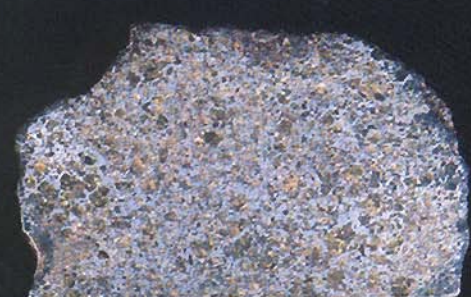
42



GLORIETTA MOUNTAINS, NEW MEXICO USA

PALLASITE, STONY IRON, 220 grams. THIS IS A COMPLETE SPECIMEN AS FOUND. NOTE OLIVINE CRYSTALS, TORN TWISTED METAL IRON.

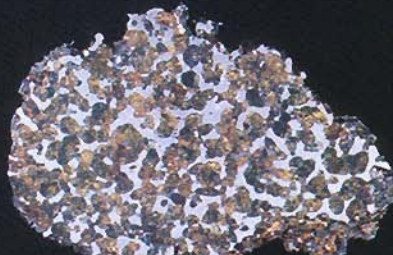
43



ADMIRE, KANSAS USA

PALLASITE, 2 kg. SLICE. NOTE HOW SHATTERED AND BROKEN THE OLIVINE CRYSTALS ARE. COMPARE TO DORA BELOW.

44



THEIL MTS., ANTARCTICA

PALLASITE SLICE, 535 grams. THE OLIVINE CRYSTALS APPEAR AS SMALL "BUBBLES" IN THE MATRIX OF Fe. VERY SIMILAR TO SPRINGWATER.

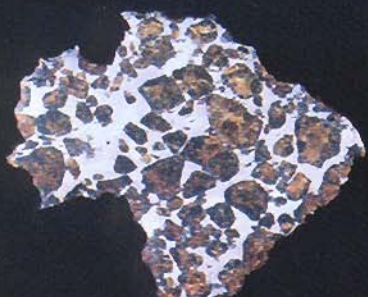
45



IMILAC, CHILE

PALLASITE. A COMPLETE SPECIMEN OF 17 kg FOUND IN ITS OWN SMALL CRATER. NOTE BLACK FUSION CRUST OF TOP PORTION.

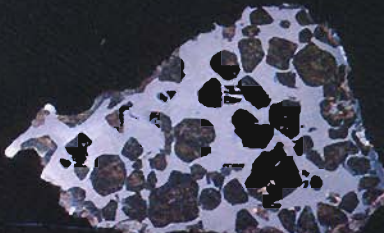
46



DORA, NEW MEXICO USA

PALLASITE, 162 gram COMPLETE SLICE. A VERY BEAUTIFUL STONY IRON OF 7.6 kg. WAS PLOWED UP, PLACED BY A FENCE IN 1955.

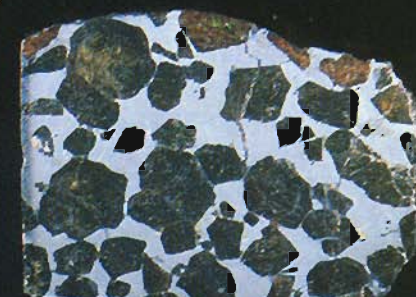
47



SOUTH BEND, INDIANA USA

PALLASITE, 264 gram SLICE. A MASS OF 2.3 kg. WAS FOUND IN 1893. MUSEUM TRADE.

48



AHUMADA, MEXICO

PALLASITE, 295 gram SLICE. NOTE HOW THE LARGE OLIVINE CRYSTAL DARKENS IN COLOR AWAY FROM THE CRUST.



**#37. Clover Springs, Arizona USA (10x7x.5 cm).** A real nice mixing of the metals and silicates again. Very well preserved. I've searched the pine tree covered hills for this one. Someone will find more of this some day.

**#38. Mt. Padbury, Australia (8x7x5 cm).** This one is quite old and weathered on the outside, and would be tough to recognize. However, if you cut or grind into the edge of this rough looking rusty rock, you'll see lots of metal. Now you can get excited!

**#39. Mt. Egerton, West Australia (4x3x2 cm).** This is a very unusual mesosiderite. It has been on the ground a long time and the iron portions have almost completely weathered away. This has very incomplete mixing and the silicate portions (enstatite) were found in a big rust-stained pile. It would be difficult to recognize these enstatite crystals as meteorites if you saw them lying around. These pieces were just found after a very exhausting, difficult trip.

Here is the second type of stony iron meteorite. Instead of pyroxene and hypersthene, these meteorites are mostly single crystals of olivine. These are called pallasites. The olivine can be very beautiful. A clear gem quality olivine is called peridot and is the birthstone for August. Gems from space!

**#40. Imilac, Chile (8x5 cm).** Single crystals of olivine grew inside of this iron/nickel metal, half iron and half stone. This is my favorite meteorite. I was fortunate enough to be featured in the September 1986 "National Geographic" with a picture of this meteorite.

**#41. Otinapah, Durango, Mexico (16x11x8 cm).** There are large and small olivine crystals together inside this meteorite. Some are a bit crushed. It doesn't show the same uniformity as Imilac in #40.

**#42. Glorieta Mountains, New Mexico USA (9x5x3 cm).** This pallasite has olivine crystals sticking out away from the iron. There are traces of fusion crust covering the iron and bits of olivine with rust here and there. Based on specimens found, at some times this stony/iron will switch back and forth from purely iron/nickel meteorite in a long "salami" shape, to stony/iron pallasite meteorite. Depending on which you find you could have an iron or a pallasite. This is a very difficult hunting area.

**#43. Admire, Kansas USA (22x15x2 cm).** This is a big slice off a 90 kg. specimen that was found years ago in Kansas. Notice how smashed up the olivine crystals are. This pallasite is very difficult to keep from rusting and breaking apart. It contains a lot of sulphur.

**#44. Theil Mountains, Antarctica - Slice (13x9x1.5 cm).** This specimen was found on the surface of a glacier in 1962 and is a pallasite stony iron meteorite. The single crystals of olivine are in almost perfect round bubbles, so they must have formed originally into this shape and remained undisturbed since the breakup of the parent body.

**#45. Imilac, Chile (22x20x16 cm).** Stony iron meteorite pallasite. A complete specimen that was found in its own impact crater high up in the Andes Mountains of Chile. In the desert the blowing sand has kept the exposed metal cleaned and oxidation free. There's only slight rusting on the surface due to minimal rainfall. The olivine crystals are still bright yellow where the wind and sand kept cleaning it like a little toothbrush. The half that laid face down in the dirt is the one facing you on the upper left. You can still see the black fusion crust melted on it as it came through the atmosphere. It's well preserved. This is very important, for many meteorites have been recognized this way. When in doubt, flip the stone over!

**#46. Dora, New Mexico USA (11x9 cm).** This would be a good pallasite to look for. There should be more specimens in the area.

**#47. South Bend, Indiana (11x7x.5 cm).** Another good example of a pallasite. This specimen was found next to a fence. Do you live nearby?

**#48. Ahumada, Mexico (9x7x1 cm).** There are large crystals of olivine in this Ahumada pallasite slice. I've been to the area on my way down to Allende. It's a vast mesquite desert with small isolated farms.



*Martin Holt - Another "Meteorite Man" with a bag of "goodies" found near the Imilac, Chile impact crater, 1987 exploration*



# STONY-IRON METEORITES - PALLASITES

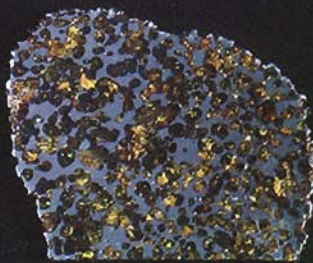
49



ALBIN, WYOMING USA

STONY IRON PALLASITE, 740 gram slice. THIS METEORITE WAS FOUND IN 1915 AND RECOGNIZED AS A METEORITE TWENTY YEARS LATER. THE PERIDOT-OLIVINE CRYSTALS ARE VERY CLEAN AND BROKEN UP THROUGH THE MASS.

50



SPRINGWATER, SASK., CANADA

STONY IRON PALLASITE, 357 gram SLICE. THE PERIDOT OLIVINE CRYSTALS ARE IN SMALL FOUND "BUBBLES" THROUGHOUT THE NICKEL IRON MATRIX. A VERY BEAUTIFUL METEORITE.

51



BRENHAM, KANSAS USA

STONY IRON PALLASITE 35 kg. THIS LARGE END PIECE IS FROM A 150 kg. METEORITE. THE OLIVINE CRYSTALS ARE ALSO UNBROKEN LIKE SPRINGWATER, ONLY LARGER.

52



HUCKITTA, AUSTRALIA

STONY IRON PALLASITE, 500 grams. ALL OF THE METAL NICKEL IRON HAS WEATHERED AWAY TO HEMATITE AND MAGNETITE. THE OLIVINE CRYSTALS REMAIN INTACT.

53



HUCKITTA, AUSTRALIA

STONY IRON MESOSIDERITE, 82 grams. A UNIQUE ENSTITITE WITH OLIVINE MESOSIDERITE.

54



VACA MUERTA, ATACAMA CHILE

STONY IRON MESOSIDERITE. THIS CUT AND POLISHED FACE BETTER SHOWS THE UNUSUAL NATURE OF MESOSIDERITES. NOTE THE EUCRITE-LIKE PEBBLE.

55



CAMEL DONGA, WEST AUSTRALIA

EUCRITE ACHONDRITE 1.133 grams. THIS BEAUTIFUL SPECIMEN HAS A CLASSIC SHINY BLACK FUSION CRUST AND WAS THE LARGEST SPECIMEN FOUND. A CALCIUM-RICH, HIGHLY CRYSTALLINE TEXTURE.

56



PASAMONTE, NEW MEXICO USA

EUCRITE ACHONDRITE, 67 grams. THE PASAMONTE SHOWER FELL MARCH 24, 1933. AFTER A HUGE FIREBALL WAS TRACKED DOWN ONLY A FEW SMALL SPECIMEN WERE FOUND. NOTE TEXTURE OF THE CRUST - VERY FRAGILE, ASHLIKE APPEARANCE.

57



STANNERN, CZECHOSLOVAKIA

EUCRITE ACHONDRITE, 396 grams. FELL 1808. THIS END PIECE EXHIBITS THE WHITE FRAGILE INTERIOR AND SHINY BLACK ACHONDRITE CRUST. VERY DIFFERENT FROM ORDINARY CHONDRITES.

58



MILLBILLILLIE, WEST AUSTRALIA

EUCRITE ACHONDRITE, 900 grams. GLASSY BLACK FUSION CRUST TYPICAL OF ACHONDRITES. NOTICE HALF THE SPECIMEN WAS ABOVE GROUND LEVEL.

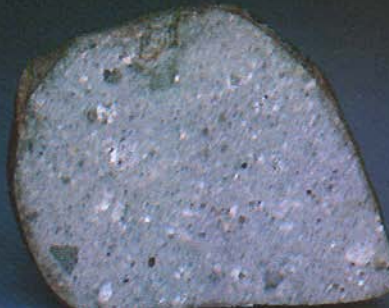
59



NEW EUCRITE, CHILE

EUCRITE ACHONDRITE, 500 grams. UNUSUAL LOOKING CRYSTALLINE STRUCTURE. NOTE FLOW LINES IN CRUST.

60



RANCHO BLANCO, MEXICO

EUCRITE ACHONDRITE, 123 grams. ACCIDENTALLY DISCOVERED INSIDE THE NUEVO MERCURIO STREWNFIELD. THAT MAKES 5 NEW DISCOVERIES AT THE SAME LOCATION!



**#49. Albin, Wyoming USA (19x14x1 cm).** Found on a grassy slope of sod, well preserved. Recognized by a rancher as a meteorite after seeing a meteorite exhibit in Denver.

**#50. Springwater, Sask. Canada (11x10x1 cm).** Springwater is very similar to Brenham below, but the olivine crystals are about 30% smaller. There is almost no trolite visible, where as cut Brenham shows a lot.

**#51. Brenham, Kansas, USA (47x33x18 cm).** A large 150 kg. mass of Brenham was found by one of the crew on an expedition. It was hit by a plow and "gouged" many times. The farmer told us about the "hard" rock in the field. He told us it had broken the tip of his plow. The specimen was found about 3 feet down in the dirt using a metal detector. My favorite detector is the White 6000 series.

**#52. Huckitta, Australia (9x9x8 cm).** This is another pallasite, but it's a very, very old pallasite. It's similar to the Mt. Egerton, the mesosiderite, where the iron had all rusted away and left the enstatite crystals that I mentioned in #39. Instead of the iron rusting away, the iron turned to hematite and magnetite. Here you can see the hematite, an oxide of iron rust, similar to shale balls, but it was very uniform and non-destructive in the transition. The olivine crystals are still very obvious inside this meteorite.

**#53. Bencubbin, West Australia (5x3x1 cm).** There are sometimes other inclusions in stony iron meteorites that make them their own unique class. Bencubbin is a very unusual mesosiderite. It has enstatite crystals and olivine and clasts of chondritic material, mixed with trolite and finely interlaced silicates. The metal is hexadrite (6.6% nickel) but no etched Newman lines. Very rare.

**#54. Vaca Muerta, Atacama, Chile (25x23x8 cm).** You can find extremes from one end to the other of the mixing of the irons and stones with the stony irons. This is an example of a stony type meteorite material (pyroxene and plagioclase crystals) found with this mesosiderite. These clasts are similar to calcium rich achondrites, called eucrites. From examples like this scientists are fairly certain that the mesosiderite parent body and the eucrite stone meteorites are one and the same.

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Now, we're going to begin the last division of meteorites-stones. Stone meteorites are the most common of all meteorites to fall, over 90%, but much more difficult to recognize than irons. There are two main classes of stone meteorites, achondrites and chondrites. First, we'll look at the achondrites (without chondrules). They are generally more crystallized and are very similar to terrestrial earth rocks. Achondrites are further divided into two categories, calcium rich (more than 5%), or calcium poor (less than 3%). Calcium-rich achondrites are the most common. We'll start with eucrites.

**#55. Camel Donga, West Australia (11x10x7 cm).** Look at the shiny black fusion crust, typical of calcium rich achondrites. This is a very well preserved iron-rich achondrite. It's similar inside to #57, but more metal is visible.

**#56. Pasamonte, New Mexico USA (5x3.5x2.5 cm).** The Pasamonte fireball was one of the largest fireballs ever seen in recent times. It was brighter than the sun. Although based on the dust in the air, the estimated mass was over a million tons, all that landed on the ground and was picked up were a few small stones. There must be more out there somewhere!

**#57. Stannern, Czechoslovakia (10x7.5x5 cm).** Many eucrites are brecciated and can change somewhat in composition between stones. Several hundred stones were found after a bright fireball and detonations.

**#58. Millbillillie, West Australia (12x10x8 cm).** This eucrite was a witnessed fall in the 60s. It has a very glassy burnt crust, typical of eucrites. You can see where part of it was below the soil when it was recently recovered. Local aborigines found many complete stones once they were educated in what to look for. When you offer people enough reward money, they will go and look.

**#59. New Eucrite, Chile (9x8x4 cm).** Look at the flow lines on the crust of this meteorite. It shows good orientation and is very well preserved. Found by a geologist in the vast dry desert of Chile.

**#60. Rancho Blanco, Mexico (6x4x4 cm).** I was buying small Mercurio stones at the fall site in Mexico, #85, when the locals who are meteorite conscious found a new one. It was recognized by a tiny amount of remaining fusion crust.



# STONE METEORITES - CARBONACEOUS AND ACHONDRITES

61



CUMBERLAND FALLS, KENTUCKY USA

AUBRITE ACHONDRITE, 49 gram SLICE. FELL IN 1919. SOME SPECIMENS CONTAIN UNIQUE CHONDRITIC INCLUSIONS. MADE OF ENSTATITE CRYSTALS.

62



NORTON CO., KANSAS USA

AUBRITE ACHONDRITE, 894 grams. A LARGE FRAGMENT WITH A CREAM COLORED CRUST (CA. POOR). SEEN TO FALL IN 1948 AFTER A BRIGHT DAYLIGHT FIREBALL.

63



MAYO BELWA, NIGERIA

STONE AUBRITE, 84 gram. ACHONDRITE. A SMALL STONE FELL IN 1974. THIN, MILKY CLEAR FUSION CRUST. VERY DIFFICULT TO RECOGNIZE.

64



JOHNSTOWN, COLORADO USA

DIOGENITE ACHONDRITE, 762 grams. THIS SPECIMEN FELL JULY 24, 1924. PART OF THE BLACK FUSION CRUST CAN STILL BE SEEN. BECAUSE OF ITS CALCIUM POOR, THIS CRUST IS NOT SHINY LIKE IN EUCRITES.

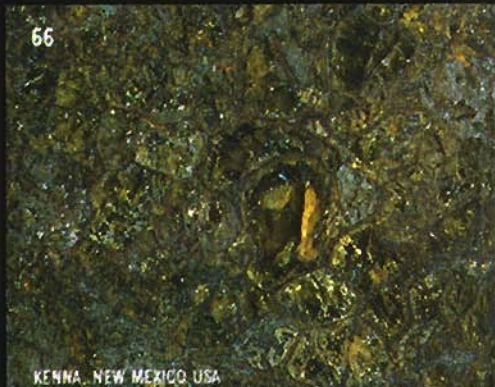
65



TATAHOUINE, TUNISIA

STONE, ACHONDRITE, 12 grams. DIOGENITE. MANY SMALL GREENISH STONY FRAGMENTS WERE SEEN FALLING IN 1931 NEXT TO THE VILLAGE OF THE SAME NAME.

66



KENNA, NEW MEXICO USA

UREILITE ACHONDRITE, 22 grams. PHOTOGRAPH OF A POLISHED SLICE. A 10 kg. STONE WAS RECOGNIZED BY THE FUSION CRUST FOUND ON THE BOTTOM OF THE SPECIMEN. THE REST HAD WEATHERED AWAY. VERY RARE.

67



NAKHLA, EGYPT

SNC NAKHLITE STONE ACHONDRITE, 14 grams. GREEN CRYSTALS. BASALTIC VOLCANIC ROCK PROBABLY FROM THE SURFACE OF MARS. EXTREMELY RARE.

68



ZAGAMI, NIGERIA

SNC STONE SHERGOTTITE, 392 grams. ACHONDRITE. SEEN TO FALL IN 1962. BASALTIC VOLCANIC ROCK, POSSIBLE FROM THE SURFACE OF MARS. EXTREMELY RARE, PYROXENE AND PLAGIOCLASE GLASS.

69



KAPOETA, SUDAN

HOWARDITE ACHONDRITE, 129 grams. THIS METEORITE FELL ON A ROAD DURING WWII. BASICALLY A "SOIL" MIX FROM A LARGE ASTEROID.

70



ORGUEIL, FRANCE

STONE C-1, 12 gram CARBONACEOUS CHONDRITE. EXTREMELY RARE. SEEN TO FALL IN 1864. NOTE CRUST, ASSOCIATED WITH COMETS. CONTAINS MINERALS THAT WERE EXPOSED TO WATER, IN COMETS.

71



MURCHISON, AUSTRALIA

CARBONACEOUS CHONDRITE CM2. FELL SEPT. 28, 1969. 373 grams. THIS SPECIMEN SHOWS GOOD CRUST DETAIL WITH SURFACE REGMAGLYPTS. SEE CLOSE-UP OF CHONDRULES.

72



ALLENDE, CHIHUAHUA, MEXICO

CARBONACEOUS CHONDRITE VC3. FELL FEB. 8, 1969. 17 kg. STONE. THIS IS A VERY LARGE SPECIMEN RECOVERED FROM A GARAGE WHERE IT WAS USED TO BLOCK WHEELS WHILE WORKING ON CARS.



Here's another type of achondrite called aubrites. They are all mostly pure magnesium silicate, called enstatite.

**#61. Cumberland Falls, Kentucky USA (7x6x5 cm).** Aubrite achondrite. The enstatite crystals have been smashed up here and there. Scientists have found small pieces of ordinary type chondrite meteorite material mixed in with some of this hard to recognize type of achondrite stone.

**#62. Norton Co., Kansas USA (10x9x8 cm).** Look at the fusion crust on top of this one. Since it's calcium poor and has very little iron, it doesn't make a very dark crust. You can see that the material inside is a milky white color. There are sporadic rusty stains here and there from little clumps of rusting iron.

**#63. Mayo Belwa, Nigeria (5x4x3.5 cm).** This is another aubrite achondrite. There are little bits of stain here and there of the metal inclusions but here's something really unusual. Very small vesicles are visible. Almost no fusion crust on this specimen's exterior. It was seen falling, of course, or no one would have believed it to be a meteorite. The rust of metal gave it away.

---

Now we're going to start another type of achondrite, a group called diogenites.

**#64. Johnstown, Colorado USA (9x9x5 cm).** Hypersthene crystals in smashed and brecciated angular hypersthene crystals. Diogenites and eucrite parent bodies are related. Sometimes you will find fragments mixed together, one inside the other. The diogenites probably settled out of the molten eucrite/diogenite parent body earlier. It is difficult to recognize. There is very little metal present. You can still see some of the black burnt fusion crust. Calcium poor.

**#65. Tatahouine, Algeria (Image area 2x2 cm).** Achondrite, diogenite, an almost plastic looking mineral. A daytime fireball exploded above the desert and showered a small area. The Bedouins (local people) recovered several hundred small pieces. There are virtually no metal fragments and all the pieces totaled only a few kilos. This is also very difficult to recognize. No crust covers any of the pieces. It last blew apart at a low enough speed to avoid any melting of the surface on these hypersthene crystals.

**#66. Kenna, New Mexico USA (Image area .5x5 cm).** This is a slice of ureilite. Ureilites are the most iron/nickel rich of all achondrites. They are made of olivine, clinopyroxene in a black carbon rich matrix. Tiny diamonds have been found in these. Possibly related to the carbonaceous chondrites.

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Now, we're going to another type of achondrite. This is my favorite, the most interesting. They're called collectively as a group, S.N.C.s, based on three meteorites that have been found and are believed to be from the surface of Mars. S.N.C.s are basaltic, cumulate rocks.

**#67. Nakhla, Egypt (2x1.5x1.5 cm).** Nakhlite, mostly augite which is very dark green, needle-like crystals. It falls apart easily. The fusion crust is calcium rich. Look at the shiny crust. The faster a magma material cools and crystallizes, the smaller the size of its crystals. A dog was killed by one of these falling stones.

**#68. Zagami, Nigeria (9x6x4 cm).** S.N.C. This is a shergottite achondrite. These shergottites are basaltic (volcanic) type rocks. Researchers believe these come from Mars. Somewhere in the magma chamber this material cooled and the new crystals inside settled out at random as if you spilled a bunch of needles. This cooled and solidified about 1.2 billion years ago. An asteroid or comet impact on Mars is the only way to have blown it off the surface and sent it flying our way. Mars is the closest planet, large enough to have volcanoes, so it's the most likely candidate.

**#69. Kapoeta, Sudan (5x3.5x3 cm).** This is another type of achondrite called a Howardite. This is basically soil off of an asteroid or a small moon. It is made of broken chunks of different kinds of meteorites that have plowed into the asteroid. These broken up fragments resolidified under pressure. The Howardites are mostly eucrite and diogenite material. Cm2 fragments can be seen in this cut face. The Kapoeta meteorite fell during WWII on a road.

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*Carbonaceous and ordinary chondrites are classified by how much the material (chondrules) has been altered from its original state by exposure to heat and pressure and alteration from water. C-1 types are the most water-altered and the least heat-altered. C-2s are somewhat altered and C-3s none. C-1s contain carbonate and sulfate silicate minerals. These formed in a wet, warm area. The fact that water is found in meteorites is so cool. I can't stand it! There must be more "earths" out there. Ordinary chondrites were not exposed to water and their petrologic numbers begin at 3 and go up to 6 - the most heat and pressured altered. The more you squeeze the chondrules the more they break up. Still more pressure will squeeze the metal iron until it begins to flow like a liquid (similar to Mercury). Soon the chondrules are under so much pressure they are almost liquid, then the material is recrystallized and the chondrules are no longer visible. The amount of squeeze depends on how large the parent body was and how deeply buried the material was. The larger the parent body, the more capable it is of completely remelting the chondrite material into achondrites. Achondrites have no chondrules. Get the picture?*

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**#70. Orgueil, France - Carbonaceous Chondrite (3.5x2x1 cm).** These are the most carbon rich of the meteorites. This is a type C1. You can see hydrated minerals, the white crystals in this piece. This means that the material had water flowing through it at one time. This was probably a comet. These are real exotic and sought after primitive type meteorites. Primitive meaning they've undergone the least amount of change since their formation.

**#71. Murchison, Australia. C2 (9x6x6 cm).** Murchison was also exposed to water and it contains something very unique. Amino acids have been found inside this rare meteorite. Amino acids are the basic structures of proteins and proteins are basically what DNA and RNA are made from. This meteorite had a strange smell to it, similar to ether when it fell.

**#72. Allende, Chihuahua, Mexico. C3 Carbonaceous (31x22x19 cm).** Several thousand kilograms of this fell into the fields and ranches of Chihuahua, Mexico in 1969 - the same year we landed on the moon. This is a very popular collector meteorite. This particular specimen was used in a garage to block the wheels of a car while they were changing the tires.



# STONE METEORITES - CARBONACEOUS AND ORDINARY CHONDRITES

73



KAROONDA, SOUTH AUSTRALIA

STONE. C5, 84 gram CARBONACEOUS CHONDRITE. RARE VERY FINE-GRAINED METAMORPHOSED MATERIAL. SEEN TO FALL NOV. 25, 1930.

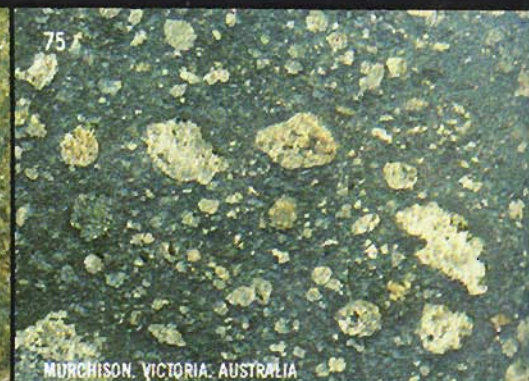
74



ALLENDE, CHIHUAHUA, MEXICO

CARBONACEOUS CHONDRITE, CV3, 50 grams. CLOSE-UP PHOTOGRAPH OF TYPICAL CHONDRULES. SOME SMALL C.I.A. CAN ALSO BE SEEN IN THIS POLISHED SLICE.

75



MURCHISON, VICTORIA, AUSTRALIA

CARBONACEOUS CHONDRITE, CM2. CLOSE-UP PHOTOGRAPH OF SMALLER CHONDRULES WITHIN THE MURCHISON STONE. THE MATRIX IS MUCH DARKER THAN ALLENDE. 50 gram SLICE.

76



COLONY, OKLAHOMA USA

CARBONACEOUS CHONDRITE (CO3), 165 gram SLICE. FOUND CAUGHT IN THE TINES OF A COTTON CULTIVATOR. DIFFICULT TO RECOGNIZE. VERY TINY CHONDRULES

77



PARMALLEE, INDIA

STONE AMPHOTERITE, 332 grams (LL3). THE MOST PRIMITIVE OF ORDINARY TYPE CHONDRITES. NOTE ROUND CHONDRULES ON BROKEN AND CUT EDGES, FELL IN 1857.

78



LAKE LABYRINTH, AUSTRALIA

STONE METEORITE LL6 AMPHOTERITE. A RARE TYPE OF STONE AMPHOTERITE HAVING MUCH LESS METAL THAN ORDINARY CHONDRITES.

## STONE METEORITES - WITNESSED FALLS

79



ENSISHEIM, FRANCE

STONE (LL6), 176 gram STONE AMPHOTERITE. FELL IN 1492 AND HAS BEEN KEPT IN A CHURCH EVER SINCE.

80



BJURBÖLE, FINLAND

STONE (L4), 150 gram FRAGMENT. A VERY FRIABLE METEORITE MADE UP OF TINY BLACK CHONDRULES THAT COME OFF WHEN YOU HANDLE IT.

81



KNYAHINYA, USSR

STONE (L5), 434 gram OLIVINE HYPERSTHENE CHONDRITE. OVER 1000 STONES WERE RECOVERED AFTER A LARGE FIREBALL IN 1866.

82



LA CRIOLLA, ARGENTINA

STONE METEORITE L6, 6 kg. THIS FRESH STONE FELL TO EARTH ON JAN 6 1985. THE SURFACE SHOWS DEEP THUMB PRINTS AND GOOD BLACK FUSION CRUST. NOTE THE WHITE INTERIOR.

83



BRUDERHEIM, ALBERTA, CANADA

STONE METEORITE L6, 830 gram. FELL MARCH 4, 1960 IN THE SNOW. COMPLETELY COVERED IN FUSION CRUST. NOTE SURFACE DETAILS.

84



NAKHON PATHOM, THAILAND

STONE (L6), 96 gram OLIVINE HYPERSTHENE CHONDRITE. NOTE UNUSUAL LIGHT AND DARK BRECCIATED PORTIONS.



# STONE METEORITES - FALLS AND FINDS

85



NUEVO MERCURIO, MEXICO

STONE METEORITES (H5) SEEN TO FALL IN 1978. THE LARGEST IS 950 grams. NOTE ORIENTATION ON SMALLER SPECIMENS.

86



CHAING KHAN, THAILAND

STONE METEORITE (H6), 682 grams. FELL 1982 ALONG THE THAILAND/LAOS BORDER. THIS SPECIMEN WAS FOUND IN LAOS.

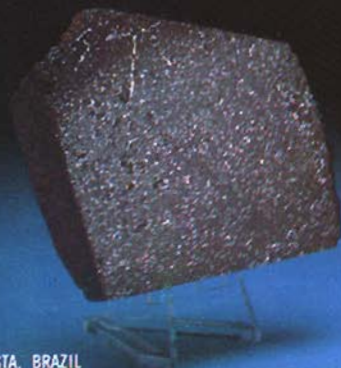
87.



TENHAM, AUSTRALIA

STONE METEORITES (L6). LARGEST IS 1400 grams. FOUND RECENTLY OVER 100 YEARS AFTER THE FALL STILL IN GREAT SHAPE.

88



CONQUISTA, BRAZIL

STONE (H4) SLICE, 408 grams. SEEN TO FALL IN 1965. THIS SLICE IS OFF THE 20 kg. MAIN MASS.

89



PULTUSK, POLAND

STONE H5, 224 grams. OVER 100,000 STONES LIKE THIS FELL WOULD YOU RECOGNIZE THIS?

90



HOLBROOK, ARIZONA USA

STONE METEORITE, 1550 grams (L6). PART OF A LARGE SHOWER OF STONE SEEN TO FALL JULY 19, 1912.

91



NEW STONE FROM IOWA, USA

A SINGLE 134 gram SPECIMEN WAS SENT TO MY OFFICE WITH VERY LITTLE BACKGROUND. GIVEN TO A SCHOOL TEACHER AFTER IT WAS SEEN TO FALL IN IOWA (H4).

92



JULESBURG, COLORADO USA

STONE CHONDRITE SLICE, 656 grams. FOUND AT A LANDFILL! SOMEONE THREW AWAY A SMALL FORTUNE NOT KNOWING WHAT THEY HAD! 56.6 kg.

93



PLAINVIEW, TEXAS USA

STONE METEORITE H5, 1230 grams. THIS PHOTOGRAPH SHOWS GOOD SURFACE DETAIL. THE BLACK CRUST IS JUST STARTING TO WEATHER BROWN.

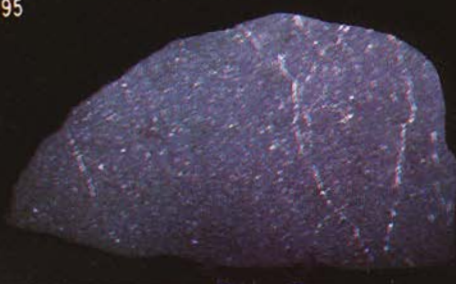
94



VULCAN, CANADA

STONE (H6) SLICE, 177 grams. NOTE HOW MUCH METAL IS INSIDE THIS SLICE. THE KEY TO FINDING METEORITES IS METAL PRESENT.

95



ETTER, TEXAS USA

STONE METEORITE L6, 1000 gram SLICE. LIKE MOST STONE METEORITES, BRIGHT FLAKES OF METAL CAN BE CLEARLY SEEN. NOTE THE WEAVING OF THE METAL ON THE RIGHT SIDE.

96



ANTARCTICA 76009

STONE METEORITE FRAGMENT L6, 200 grams. THIS SPECIMEN WAS SPOTTED FROM A HELICOPTER FLYING OVER THE BLUE ICE WHILE



#73. **Karoonda, South Australia. C5 Carbonaceous (7x5x3 cm).** There has been so much pressure and temperature on this carbonaceous meteorite that the matrix material is altered and basically crushed into a fine grain material. There are no chondrules present. You keep hearing about chondrules. Chondrules are tiny millimeter size round nodules or spheres that are left over from the original swirling clouds of dust that made our solar system. Mainly pyroxene and olivine. Most stone meteorites contain them. One way of recognizing stone meteorites is by these chondrules.

#74. **Allende, Chihuahua, Mexico. CV3 (Image area 1x1 cm).** Here's a close-up of a slice of carbonaceous chondrite. You can see it is made of chondrules. Some are more broken up than others.

#75. **Murchison, Victoria, Australia. CM2 (2x1 cm).** Look at these very small chondrules in this close-up. These chondrules are surrounded by a diamond-rich carbon matrix.

#76. **Colony, Oklahoma USA. CO3 (9x7x1 cm).** Here's a very old carbonaceous chondrite. The chondrules in this slice are very small but visible to a trained eye. Years of rains and ground water have rusted the metal grains in the chondrules. Hard to recognize.

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There are four main ordinary chondrite groups. LLs, Ls, Hs, and E chondrites. These are all more compressed and altered than carbonaceous chondrites. First the LLs, called ~~amphoterites~~.

#77. **Parnallee, India. LL3 (6x5x4 cm).** A very primitive type meteorite. You can see the material is made of chondrules but it's slightly compacted together. Some tiny amount of squeezing.

#78. **Lake Labyrinth, Australia. LL6 (10x5x.5 cm).** This is as high as the petrologic numbers go. This meteorite has been subjected to a lot of pressure and temperature and the chondrules are hardly visible at all, and now it's beginning to weather.

#79. **Ensisheim, France. LL6 (7x6x4 cm).** Fell in 1492. It's one of the oldest meteorites known. You can see the metal, but almost no evidence of chondrules. The high petrologic end number (#6), means the most damage to other chondrules because it was buried deeper in the parent body.

Now, let's look at H and L groups. Hs and Ls are almost the same, there are more Ls than there are Hs with low metal being the L types and high metal being the H types. That's overall metal, not necessarily visible.

First we're going to talk about falls versus finds. Falls means people actually saw the stones come out of the sky. Here are some really good examples.

#80. **Bjurböle, Finland. L4 (7x6x5 cm).** This meteorite fell on sea ice. This material is made completely of chondrules and is extremely fragile. The low petrologic end number (#4) means slight pressure damage to the chondrules.

#81. **Knyahinya, Russia (8x6x5 cm).** Look at the delicate crust. Would you know this was a meteorite if it was in your backyard?

#82. **La Criolla, Argentina (18x14x12 cm).** Look how classical the burnt crust is. It shows good surface features. Recall the thumb printing, like on the iron meteorites? This is going to be on other meteorites too. The black crusted semi-crystallized rock (L6) hit the ground and broke in these people's yard. Where the crust broke you can see it's just like cement inside. Dozens more fell into the surrounding town and orange trees. I went here almost 6 months after the fall and recovered nearly 50 kg.!

#83. **Bruderheim, Alberta, Canada (10x9x7 cm).** These are all nice pieces because they fell in soft snow after a midnight fireball. Locals found these black rocks on the snow. They landed softly and there's no break in the fusion crust.

#84. **Nakon Pathom.** A fall in Thailand. Look at what's gone on inside this meteorite. Sometime in its life, in the parent body, it was crushed up (called brecciated) and the materials came together again like conglomerate rock. Broken up sections resolidified together.



**#85. Nuevo Mercurio, Mexico (8x7x6 cm).** We found thousands of these in the desert in Mexico. The whole town combed the desert and even discovered a new specimen overlapping this fall. See #60.

**#86. Chaing Khan, Thailand (9x6x5 cm).** This fell in 1982. It fell near to the Golden Triangle (an interesting?) place to hunt. Sure you're looking for meteorites, Yankee! Look how the iron has started to stain through the crust.

**#87. Tenham, Australia (13x9x7 cm).** This fell 100 years ago in a very dry area of West Australia. Recent Meteorite hunters returned to the site and recovered an additional 30 kgs. and found another new weathered meteorite. See #105. Look at how some of the pieces are starting to rust. These were found in dry riverbeds.

**#88 Conquista, Brazil H4. (9x8x2.5 cm).** This fell in 1965. Look at the metal pieces inside of this stone meteorite. Because it's a wet area in Brazil, and a lot of moisture and humidity in the air the silicates are getting stained by the rusting of the iron.

**#89 Pultusk, Poland H5. (6x5x3 cm).** It was estimated that over 100,000 stones must have fallen so there must be more lying around waiting to be found. Can you guess what they look like now? - Rusty brown.

**#90 Holbrook, Arizona USA. L6 (16x10x7 cm).** Thousands fell into the dry desert area of sand dunes. It's well preserved. As the sands shift more specimens will surface. This will be a good place to hunt for years to come.

**#91 New Stone from Iowa, USA (6x5x3 cm).** Melted crust. This is the best way to recognize stone meteorites, that's why we're stressing this so much. Look at the crust, the melted skin on the outside. The chondrules are visible where the crust is broken away.

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Now, let's talk about meteorites that are called finds. That means that nobody actually saw them fall out of the sky. They could have fallen last night, or last year or 10,000 years ago, but nobody knows exactly when. You can guess by the amount of weathering as to how long ago the meteorite fell.

**#92 Julesburg, Colorado USA (18x16x1 cm).** This is a real find. Meteorites can be found virtually anywhere. This one was found in a landfill. The whole mass weighed over 56 kilos. Can you believe someone threw away a meteorite worth easily \$1.00/gram, or \$56,000. Oh well, he should have read my catalog!

**#93 Plainview, Texas USA (14x7x4 cm).** Over 1,000 stones were found in this 25-mile long strewnfield area in Texas, on farmland where there are no rocks. As soon as residents learned about this gold mine and found out the stone meteorites were worth money, they kept their eyes open for these rocks. Many were recovered as well as a bunch of new meteorites. The farmers became meteorite conscious. Look at how it's starting to stain on the outside. It's not really nice and black anymore, it's kind of a rusty colored black.

**#94 Vulcan, Canada.** Lots of metal in this cut face. It looks like the stars of night. There's so much metal in this meteorite. This is another H chondrite. I love the name. I wonder if Spock lives nearby?



*The La Criolla Argentina fall. This piece was found under the orange tree behind him.*

**#95 Etter, Texas USA (28x14x1 cm).** Look at what happened to the metal flakes in this stone meteorite from Etter, Texas. They went liquid from the squeeze (Type L6) and settled themselves into veins, so it's called a veined chondrite. As meteorites weather, they'll rust along these metal rich veins because the metals will rust faster than the silicates and they'll break apart.

**#96 Antarctica (8x6x2 cm).** This specimen was found on the blue ice by helicopter. In the frozen wastelands of Antarctica during the warmer times of the days the ice can turn to water on the surface of the meteorite. Even in Antarctica there is still weathering. The elements, blowing ice crystals or the water can eat away at the meteorite.





*Try to find the meteorite here  
and convince the local people  
you're not an American spy that  
wants to steal their children!  
P.S. I don't speak Arabic!*

*Nahkla, Egypt field trip, 1984*

**#97 Melvern Lake, Kansas (20x13x11 cm).** Notice the outside of this stone meteorite. It was recognized by the weight of the piece and the thumb printing. Compare this to the La Criolla fresh fall #82. You can still see the thumb printing on the outside but now its got this nice brown staining.

**#98 Wellman "C", Texas (16x13x11 cm).** Look at how the fusion crust and thumb printing is still very obvious to the trained eye. It's worth it to study.

**#99 Hammon Downs, Australia (7x7x2.5 cm).** Look closely at the black crust starting to rust. Can you see the grains of more melt resistant metal flakes in the crust?

**#100 Neenack, California USA (14x11x1.5 cm).** A stone, you can still see a little bit of the fusion crust on the outside. It's starting to weather. Approximately half of the material is stained. This specimen was found right outside of Los Angeles.

**#101 Faith, South Dakota USA (20x18x12 cm).** The fusion crust is stained and rusted. Look at the "flow" pattern of this crust. This is from a large specimen.

**#102 Djerj, Alergeria (9x7x3 cm).** The fusion crust has been baked in the sun and desert for many years. Inside you can still see the metal flakes that proves it's a meteorite. This is not the same as desert varnish which is only on the top of some desert rocks.

**#103 Macy, New Mexico USA (5x4x3 cm).** Almost completely rusted through or stained, the little bits of metal flakes and chondrules that aren't oxidized are occasionally seen.

**#104 Correo, New Mexico USA (5x4x3 cm).** This is a complete small stone that I found in a blow out small dune area west of Albuquerque. The wind is blowing away the sand and constantly uncovering more meteorites.

**#105 Ingella Station, Australia (30x20x20 cm).** This is a very old stone meteorite. It's starting to break apart along the metal rich veins. Remnants of crust are still visible on this rusting rock.

**#106 Pampa C, Chile (16x13x9 cm).** This is the oldest and most weathered stone meteorite in my collection. There is virtually no metal left at all. The chondrules are hardly visible, and the fusion crust has completely weathered away. Incredibly difficult to recognize and not worth very much scientifically. This specimen was found purely by accident when a friend in Chile stopped to fix a flat tire on his jeep and needed a support for his jack.

Now, we'll look at one last rare type of the chondrite. These are called E chondrites. They are the most reduced of all chondrites. All the iron is in sulphides or as free metal. The other host material is enstatite.

**#107 Eagle, Nebraska USA (13x6x3 cm).** This is an EL6. That's a lower metal type of the E chondrites. It looks similar to some ordinary chondrites.

**#108 Abee, Canada (9x5x4 cm).** This is an EH4. High metal. Enstatite chondrites are the most metal rich of all the stony meteorites. These are also very rare.

The very last thing we're going to talk about is tektites. Tektites are very mysterious silicate materials whose origins are unknown. The most accepted theory is that they are made from melted earth rock and meteorite mixed together into a liquid and splashed high into our atmosphere from a huge meteor impact. But the largest meteorite impacts never made tektites and there have rarely been craters found near tektite strewnfields. It is possible these silicate tektites fell from the sky as they are. No one known. Tektites are millions of years old.



# STONE METEORITES - FALLS AND FINDS

97



MELVERN LAKE, KANSAS USA (BACKVIEW)

THIS METEORITE CLEARLY SHOWS GOOD SURFACE FEATURES AND THUMB PRINTS EVEN AFTER THE FUSION CRUST HAS WEATHERED BROWN.

98



WELLMAN "C", TEXAS USA

STONE (H4), 3378 gram OLIVINE BRONZITE CHONDRITE, FOUND IN 1964. EXHIBITS GOOD SURFACE FEATURES, SLIGHTLY WEATHERED.

99



HAMMON DOWNS, AUSTRALIA

STONE (H4), 211 gram END PIECE. ANOTHER NEW STONE WAS FOUND INSIDE THE TENHAM STREWNFIELD. PROOF MORE ARE OUT THERE IF YOU JUST LOOK.

100



NEENACK, CALIFORNIA USA

STONE METEORITE L6 SLICE, 449 gram. A RIM OF OLD FUSION CRUST CAN BE SEEN. NOTE THE WEATHERING OF THE INTERIOR METAL GRAINS.

101



FAITH, SOUTH DAKOTA USA

STONE (H5), A 7 kg. END PIECE OFF A LARGE STONE. NOTE SURFACE OF OLD WEATHERED FUSION CRUST.

102



DJERJ, ALGERIA

A NEW CHONDRITE STONE (H5), 419 grams. SEVERAL NEW PIECES WERE FOUND IN A STREWNFIELD NEXT TO A DRILLING RIG.

103



MACY, NEW MEXICO USA

STONE METEORITE L6, 176 grams. FOUND 1984. NOTE THE EFFECT OF WEATHERING AND RUST IN THIS CUT AND POLISHED SLICE.

104



CORREO, NEW MEXICO USA

STONE METEORITE H4, 176 gram. THIS CLOSE-UP PHOTO SHOWS EXCELLENT DETAIL OF WEATHERED FUSION CRUST. FOUND IN A BLOW OUT BY ROBERT HAAG.

105



INGELLA STATION, AUSTRALIA

STONE CHONDRITE (L or H), VERY OLD WEATHERED 10 kg. SPECIMEN FOUND INSIDE THE TENHAM FALL STREWNFIELD. PATCHES OF OLD CRUST CAN STILL BE SEEN.

106



PAMPA "C", CHILE

1/2 STONE, 3160 gram. A VERY OLD METEORITE WELL PRESERVED FROM THE DRY DESERT OF CHILE. ESTIMATED AT 1 MILLION YEARS OLD. NO METAL LEFT. CHONDRULES BARELY VISIBLE.

107



EAGLE, NEBRASKA USA

ENSTATITE CHONDRITE, 396 gram END PIECE WAS SEEN TO FALL IN THE 1930s AND KEPT IN THE BARN UNTIL THIS SPRING 1987.

108



ABEE, CANADA

ENSTATITE CHONDRITE (E4), 156 grams. LARGE CRYSTALS OF ENSTATITE CAN BE CLEARLY SEEN. COMPARE THIS TO CUMBERLAND FALLS.



#109 Libyan Desert Glass, Egypt (15x14x6 cm). This big specimen was found in the Sahara Desert in a small strewnfield. The clearest of all tektites.

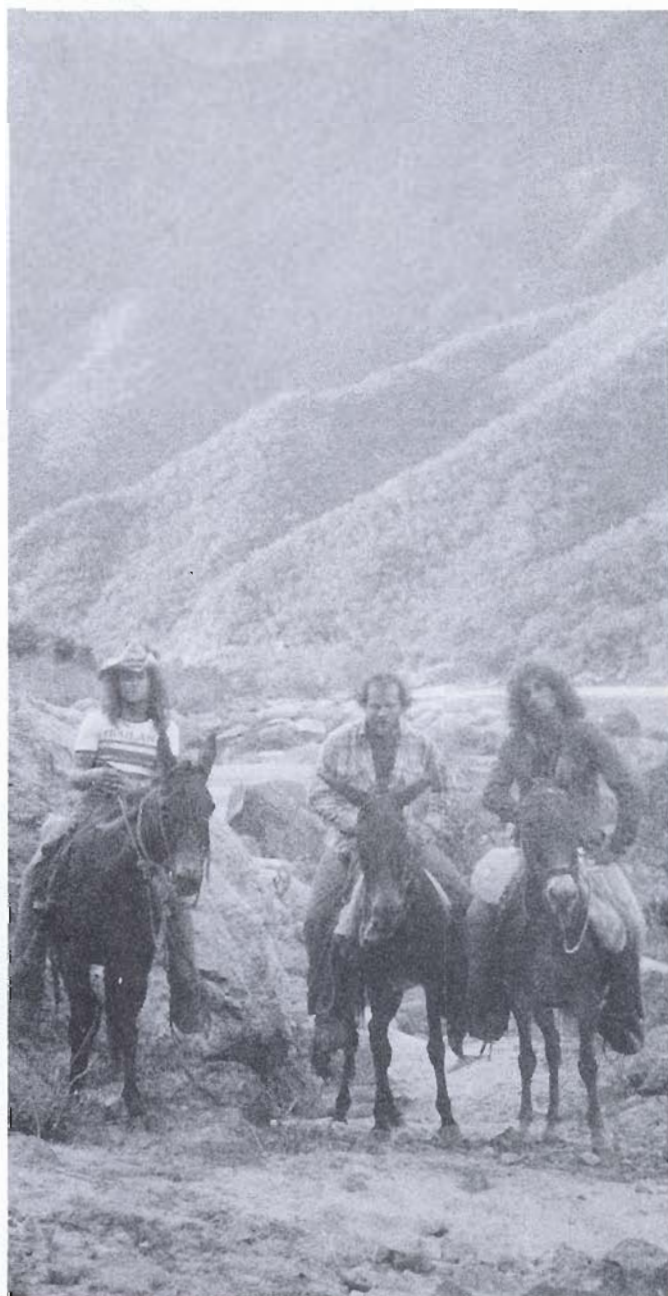
#110 Moldavites, Czechoslovakia (4x3x2 cm - largest piece). Faceted gemstones and natural as found specimens. Moldavites are bottle-green silica glass.

#111 Rizal Province, Luzon Island, Philippines (6x5x5 cm). These are best known for their very unusual surface features.

#112 Indochinites, Thailand (10x3x2 cm - longest). Probably the most common tektites. Some have unusual flight markings on them. As these droplets cooled some formed into teardrop shapes.

#113 The great daytime fireball of 1972 over the Teton Mountains. This huge meteor skipped across the earth's atmosphere and went back out into space. Dang! The one that got away!

#114 Millibillillie, West Australia. Another example of some flight markings. These are called flow lines. You can see how the material flows backwards from the intense pressure and melting and accumulated on the back of this picture. It actually bubbled in the low pressure as it was accumulating during its high speed flight through the atmosphere.



Deep in the Mexican Grand Canyon. Adventure is where you find it! (Left to right: Zee Haag, Ronnie Davis & myself.)

#115 The Marlow stone meteorite on the scale at work. Buying and selling space rocks is a job, but somebody has to do it. Check out the flight markings. This piece was dug up when some ranchers made a stock pond.

#116 Meteorite Man, Mark Carlton, slicing up an iron meteorite from Africa on one of our many saws. We are always keeping our eyes open for anything unusual at the shop. When we find something new, we'll send it to the University of Arizona lab for further studies.

#117 This is a faceted crystal of olivine from an Imilac, Chile pallasite. Who knows what other space gems will be found out there? Maybe "melange" really does exist. Did you read "Dune"?

#118 Author parasailing behind a jeep in the mountains of Chile looking for impact craters. Anyone can be a meteorite specialist, a "Meteorite Man", if you just go out and teach yourself about meteorites. Get out there and look for them, go for it! We have the most success hunting in places where meteorites have been found previously, finding more fragments.

#119 Surface of Mars. That's to remind you that we've already found pieces of Mars and pieces of moonrock here on earth. You might find a part of another planet or asteroid that no one has ever seen if you remember to look for the rusting, the fusion crust and the surface features

#120 Another shot in Nigeria where the Zagami, #68 Mars rock fell. That's the exact location where a million dollar meteorite landed. Who knows, there might be one in your backyard. I'm the guy in the blue shirt.

Learn to recognize meteorites and you too can be a "Meteorite Man". Do some reading. Good luck! You find them, we buy them!

Sincerely,

Robert A. Haag



# STONE METEORITES AND TEKTITES

109



LIBYAN DESERT GLASS, EGYPT

A LARGE NATURAL GLASS FRAGMENT OF 2082 grams. FOUND IN A VERY REMOTE SITE ON THE EGYPT/LIBYAN BORDER.

110



MOLDAVITES, CZECHOSLOVAKIA

SHOWN ARE SEVERAL 45 carat FACETED SPECIMENS AND SEVERAL NATURAL FRAGMENTS AROUND 15 grams.

111



RIZAL PROVINCE, LUZON ISLAND, PHILIPPINES

PHILIPPINE TEXTITE. A VERY UNUSUAL, DEEPLY GROOVED SPECIMEN OF 163 grams.

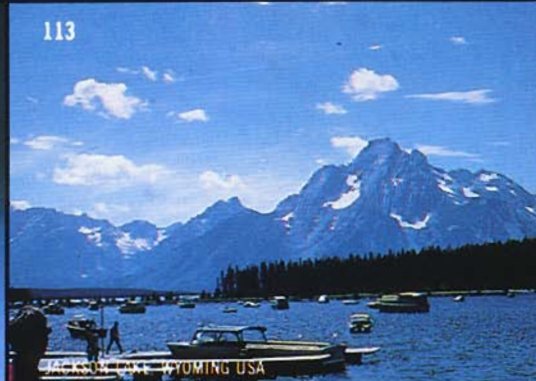
112



INDOCHINITES, THAILAND

ASSORTED TYPICAL SHAPES, AVG. 30 grams. FLOW LINES CAN BE SEEN IN SEVERAL SPECIMENS. MYSTERIOUS AND VAGUE. ORIGINS UNKNOWN.

113



JACKSON LAKE, WYOMING USA

THE GREAT DAYTIME FIREBALL OF 1972. THE FIREBALL IS OVER THE TETON MOUNTAINS AT JACKSON LAKE, WYOMING. THE METEOR WENT BACK OUT INTO SPACE! PHOTO BY JAMES M. BAKER.

114



MILLBILLILLIE, WEST AUSTRALIA

HUNDREDS OF LOCAL PEOPLE SCOURED THE DESERT TO FIND THESE RARE TREASURES. NOTE BUBBLING OF FUSION CRUST ON BACK SIDE.

115



MARLOW, OKLAHOMA USA

STONE (L5), 150 LBS. ON THE SCALE AT THE SHOP. NOTE CLASSIC FLIGHT MARKINGS.

116



MARK CARLTON

AT OUR SHOP CUTTING A SPECIMEN OF GIBEON AFRICA IRON.

117



IMILAC, CHILE

PALLASITE, .55 CARATS. A FACETED CRYSTAL OF OLIVINE PERIDOT - A TRUE SPACE GEM!

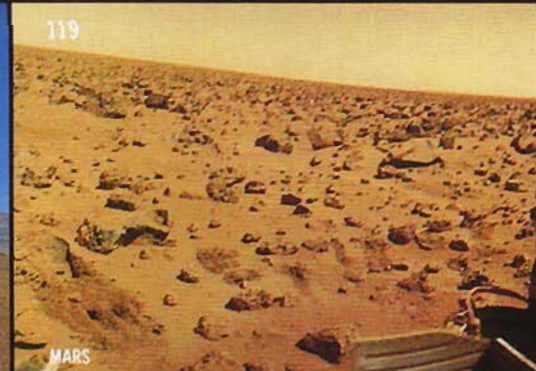
118



ATACAMA DESERT, CHILE, 1987 HUNT

AUTHOR PARASAILING BEHIND A JEEP AT 3,400 METERS IN THE IMILAC STREWNFIELD. SEARCHING FOR SMALL CRATERS.

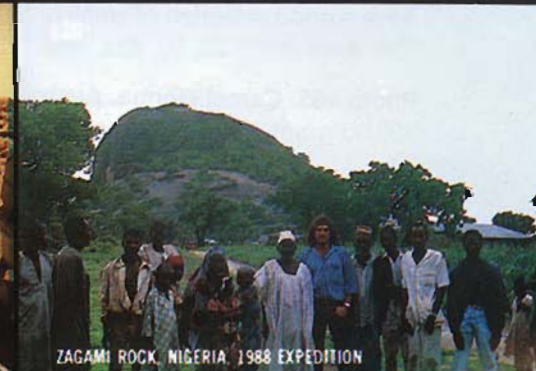
119



MARS

THE SURFACE OF MARS AS SEEN FROM THE VIKING 2 LANDER - LOOK AT ALL THOSE S.N.C.s!

120



ZAGAMI ROCK, NIGERIA, 1988 EXPEDITION

ROBERT A. HAAG (IN BLUE) AT THE FALL SITE OF THE ZAGAMI, NIGERIA MARS ROCK WITH THE ORIGINAL FOUNDER (WHITE HAT)



# PRICE LIST OF CURRENTLY AVAILABLE SPECIMENS

## IRON METEORITES

**Photo #1. Canyon Diablo, AZ Irons.** Coarse octahedrite 1A. These are some of our most popular iron meteorites and are the most distributed of all meteorites. Nice small specimens are available from \$10.00 to \$100.00 at about 50¢/gram to larger specimens up to 10 kgs. at \$220.00/kg. Sometimes I have larger specimens. Give me a call or write.

I also have a good selection of tumble-polished Canyon Diablo specimens from 200 to 500 grams at 50¢/gram.

**Photo not available. Wolfcreek, Australia.** Iron meteorite oxide. Material available up to 500 grams at \$1.00/gram.

**Photo #25. Odessa, Texas Irons.** Coarse octahedrite 1A. Odessa Texas specimens produce a very good Widmanstätten pattern when etched and are full of beautiful inclusions. I have excellent slices and a few end pieces available at \$1.00/gram from \$40.00 to \$500.00. I have a lot of nice small irons from 200 to 500 grams and I can get much larger specimens up to 20 kgs. These are priced the same as the Canyon Diablos at \$220/kg. .

I also have small tumbled Odessa iron specimens (perfect for jewelry) available at \$3.00/gram \$10.00 to \$25.00.

**Photos #8. and #15. Toluca, Mexico Irons.** Coarse octahedrites 1A. Toluca exhibit the most beautiful coarse octahedrite pattern of all when etched. This meteorite is currently being used as a Corum of Switzerland watch face. Priced at \$5000.00. I can sell you a piece at \$1.00/gram Slices start at \$50.00 to \$500.00. Complete irons are available at the same price as Odessa and Canyon Diablo. This is hard to stock and if you want a 1 kg. or larger iron, please call or write.

**Photo #25. Graphite Nodule, Canyon Diablo, AZ.** These unusual inclusions are sometimes found and are very interesting. I have a few end pieces and slices from \$50.00 to \$200.00.

**Photo #5. Mundrabilla, West Australia Iron Meteorite Medium Octahedrites/Anomalous.** I have a few complete pieces that have very nice shapes. The sizes are 47, 118, 216 and 279 grams. Priced at \$2.00/gram.

**Photo #22. Gibeon, Namibia, Iron.** Fine octahedrite. The Gibeon meteorite has superior fine-etch pattern. This is the most workable iron of all for uses in jewelry and as display pieces. I have a few complete slices that weigh over 1 kg. and smaller part slices that weigh from 20 to 500 grams. Priced at \$2.00/gram.

**Photo #11. North Chile Hexadrite IIB.** The hexadrites are much rarer than octahedrites and exhibit a structure called Newman bands. This is another good collector meteorite. I have a few small sizes from 20 to 320 grams at \$2.00/gram.

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## STONY-IRON METEORITES

**Photo #39. Mount Egerton, Australia Mesosiderite.** Incredibly rare enstatite mesosiderite. From 1 to 50 grams - \$20.00/gram.

**Photo #40. Imilac, Chile Pallasite.** I have a few complete specimens of this pallasite that were recovered on our last field trip into the Andes. The sizes are 2, 5, 9, 23, 40 and 77 grams.

I also have slices from a large specimen that are very beautiful. This gem quality olivine in metal is my most popular stony iron and is available at \$10.00/gram in 2 to 100 gram slices.

**Photo #54. Vaca Muerta, Chile Mesosiderite.** The Vaca Muerta mesosiderite is a good example of a typical stony iron. I have a good selection of small end pieces and slices from a 5 kilo specimen that I brought back from South America. The sizes are 7, 23, 90, 133, and 723 grams.

**Photo #55. Camel Donga, Australia. Eucrite,** beautiful complete stones and end pieces. From 10 to 200 grams at \$20.00/gram. Unusually metal-rich specimens.

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## STONY METEORITES

**Photos #58. and #114. Millbillillie, West Australia Eucrite Achondrite.** These Millbillillie stones are my most exciting new meteorites for this catalog. Dozens of stones were seen to fall and now are available. I have complete specimens from 10 to 200 grams as well as slices and end pieces. Priced at \$10.00/gram. All have excellent fusion.



## PRICE LIST (continued)

**Photos #72. and #74. Allende, Mexico, Carbonaceous Chondrite CV3.** The Allende stones are one of the most sought after and popular stone meteorites of all time. These were made before the sun shined! I have a few complete stones and end pieces available at \$10.00/gram. The sizes are 20, 45, and 70 gram. I can always cut a piece smaller.

**Photos #71. and #75. Murchison, Victoria, Australia C2.** This rare meteorite fell on September 28, 1969 (same year as Allende) complete with interstellar grains and one more incredible discovery. Organic compounds in the form of amino acids were found inside this unique meteorite. Cytosines, adenine, thymine, guanine, and uracil (all molecules of hydrogen, carbon nitrogen and oxygen) were discovered by Dr. Cyril Ponnamperna in his laboratory at the University of Maryland in the Murchison meteorite. The same five chemicals based on human genes were all synthesized in a single laboratory experiment designed to show how they might have formed in the primitive conditions of earth billions of years ago. Life on earth might have arisen by natural chemical processes, and may have done so elsewhere in the universe. These are fragile specimens, expensive and they even have a peculiar smell to them, but these are unique! Did the building block of life form in the harsh frigid environment of space? Could they have "seeded" life on earth? \$50.00/gram.

**Photos #68. and #70. S.N.C. Zagami, Nigeria/Orgueil, France, C1.** Sometimes I get an offer on some extremely rare meteorites like the Zagami fall from Nigeria (one of the S.N.C. - Martian meteorites and sometimes the C-1 carbonaceous chondrite fall of Orgueil, 1864) - the most probable candidate for cometary material. These precious research meteorites are sold by the carat. I have access to about 20 grams of each so please call or write for this. Sold on consignment and very expensive. Available at \$500.00/gram.

**Photo #82. La Criolla, Argentina.** Complete stones and slices at \$4.00/gram.

**Photo #85. Nuevo Mercurio, Mexico.** Stones 1 gram average. 100% complete. \$25.00/each.

**Forrest "B", West Australia L6.** This is a good inexpensive stone meteorite find. I have some small fragments and slices available at \$3.00/gram up to 140 grams.

**Photos #105. Ingella Station, Australia L5 Stone.** This is a very old meteorite with a lot of weathering. I have some complete stones and slices available at \$2.00/gram in 10 to 100 gram sizes.

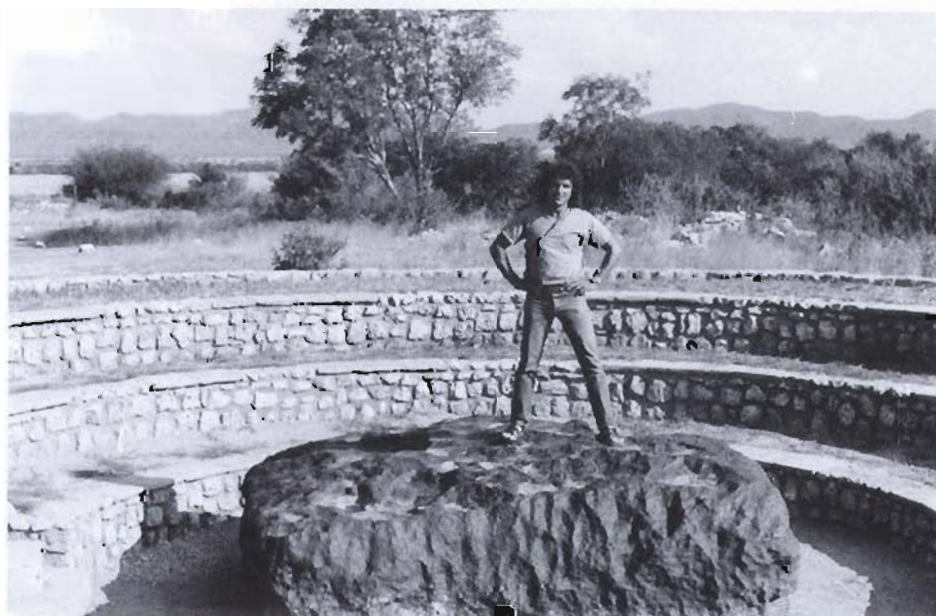
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### TEKTITES

**Photo #112. Thailand, Indochinites.** The most common of all tektites. I have pieces in all different shapes and sizes from \$5.00 to \$10.00. I also have pieces that are polished on one side for \$20.00.

**Photo #110 Moldavites, Czechoslovakia.** I have good complete specimens from 5 to 25 grams at \$10.00/gram and a few faceted stones are also available at \$20.00/carat.

**Photo #111. Rizalites, Philippines.** These rare tektites are not often available. I have a few from 30 to 100 grams. Priced at \$2.00/gram.



*The world's largest meteorite.  
Estimated weight over 66 tons.  
No, it's not for sale!  
Hoba, Africa*



# Space Jewelry

## NOW AVAILABLE ON EARTH!

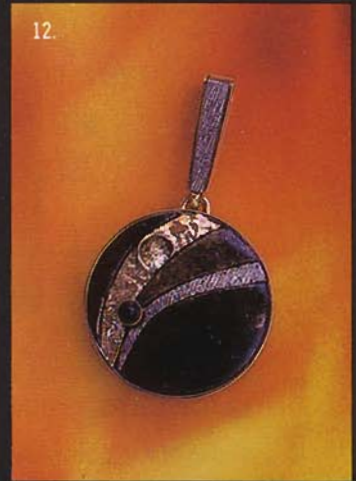
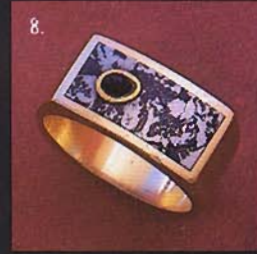
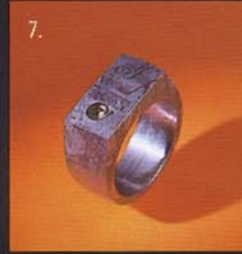
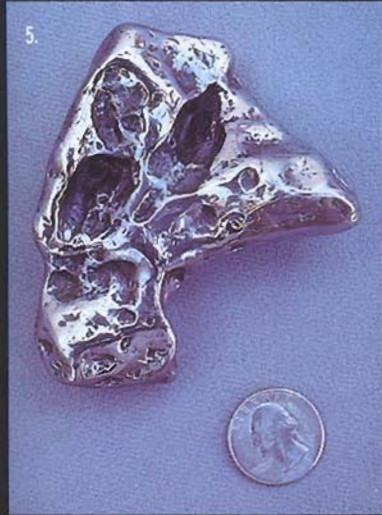
All new designs featuring the most unusual and exotic materials from around the solar system - treasures from far away!

- #1. Odessa, Texas Iron Nuggets.
  - a. Earring sets with gold electroplate, \$45 to \$55.
  - b. Earring sets, stud posts on smaller specimen, \$35.
  - c./d./e. Pendants set with gold electroplate with or without small purple sugilite stone. Your choice, \$40. Includes small chain.
  
- #2. Odessa, Texas "Nugget"-Style Pendant. (Tumble polished iron meteorite). Single tumbled specimen or several matched pieces set in silver. \$45 to \$65.
  
- #3. Odessa, Texas Nugget Ring, in men's or women's sizes. Single specimen or matched sets. \$55, women's; \$65, men's. Special order silver rings are possible, or I can sell you the rough material and have your jeweler do it.
  
- #4. Imilac, Chile Pallasite specimen, tumble polished, Gold Electroplate Pendant. Each piece is completely unique. \$65 to \$125.
  
- #5. Large tumble polished iron meteorite specimens for amazement and display. Beautiful! Priced at \$1.00/gram. From \$100 to \$500. Canyon Diablo.
  
- #6. Gibeon, Africa Ring. Custom-made band cut to your size. Drilled from select slices of Gibeon iron meteorite. From \$295.
  
- #7. Gibeon, Africa Ring. A complete band handmade exactly to your size. Beginning at \$295. Only the finest of iron meteorites are used. Custom-made rings can be etched and include a 3 mm faceted moldavite gemstone or your special order. \$395 to \$495.
  
- #8. Gold Ring with Meteorite Inlay. Landes, West Virginia and Zagami, Nigeria "Mars" rock fragment. Custom-made rings, \$695 to \$2000.
  
- #9. Odessa, Texas Nugget Earrings. Carefully matched sets in silver, \$65.
  
- #10. #11. #12. Custom made pendant pieces set in gold and combinations of these meteorites. Gibeon, Vaca Muerta, Forrest "B", and tektite. Each piece was custom-designed by Ryszard Krukowski, a famous artist from Vancouver, Canada. These are examples of what we can do once we know what you want. Priced from \$595 to \$1499 as shown. Special orders welcome.
  
- #13. Space Medallion. Made entirely from melted Canyon Diablo iron meteorites. 360 grams, approximate size is 5 cm. across. Front shows the space shuttle over earth while the back shows the orbit of the planets and the path of Halley's Comet. Limited edition of under 1000 pieces. A 3400 degree experiment, \$125. Includes a signed, numbered certificate of authenticity.
  
- #14. These iron meteorite spheres were custom made at our shop. The larger sphere is 1140 grams and is Gibeon, Africa IVA and the other is Toluca, Mexico IA, 250 grams priced at \$10,000 and \$1,000. We can special order most anything you need made out of meteorite material.
  
- #15. Earring or Pendant pieces set with stone meteorite bead in handmade wire wrap. Gold plate, silver or brass available. Please specify. \$65 to \$100. Weight of bead plus costs.

Additional styles of jewelry available. Please call or write for updated information. Supplies change and prices go up. Quantity discounts available. The more you send, the larger/nicer piece you'll receive! This is truly something special! 100% guaranteed



# Space Jewelry





## BOOKS

- #1. **Ask a Question About Meteorites, A Good Little Handbook**, by Nininger, \$5.00.
- #2. **Thunderstones and Shooting Stars**, by R. Dodd, \$25.00.
- #3. **Meteorites and Their Parent Planets**, by McSween, \$25.00.
- #4. **The British Museum Catalog of Meteorites, The Reference Bible**, a MUST, \$75.00.



## SLIDE SETS

I also have complete slide sets that were used in the catalog available for \$200.00/120 slides.

## CASTS

Plaster museum-quality casts are now available of certain complete specimens. Please write.

La Criolla, \$45.00 / Henbury \$65.00 / Tucson Ring \$25.00

## METEORITE RECOVERY TEAM T-SHIRTS

Widmanstätten pattern on the back and a fireball on the front. Sizes: S, M, L. Colors: Blue or Black. \$10.00 each.

## REFINISHING SERVICE/RE-ETCHING & POLISHING

Sometimes etched iron meteorites will rust on the polished face no matter what you do. The exotic natural chemicals in the meteorite mix with water in the air and produce rust. This can be easily taken care of. Alcohol will remove the lacquer and then simple touch-up will restore the appearance of the meteorite. However, if you wait too long, the meteorite must be re-polished and re-etched. I can do this for only \$10.00 plus return postage. Or you can do it at home! It's easy and fun. Write for the procedure, all you need is sandpaper, nitric acid and gloves.

## MISCELLANEOUS INFORMATION

All meteorites are completely guaranteed to be exactly what I say they are. I now have a collector network of over 5,000 serious collectors, so please be patient when you order something. I usually need about three or four weeks to send it out. I am out of the country a lot, and we get overloaded with orders. Remember when you order a meteorite, the sizes and weight are guaranteed minimum amount of material you will receive for that amount of money. We sell out often, so bear with us.



All the meteorites you see in this catalog are in my personal collection. If you are interested in something special or a certain size, please call me or write. I might have another piece or I may know another collector that will sell or trade.

My stock changes all the time, I might buy a parcel of Henburys or another Brenham pallasite will come on the market tomorrow. There could be a fall next week in Mexico or your town or, after you have read this catalog you might find one and sell it to me!

Good hunting!



Robert A. Haag - The Meteorite Man  
March 10, 1989

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**WE BUY METEORITES FOR THE HIGHEST PRICES - CALL US AND SEE!  
WATCH THE NEWSPAPER FOR METEORITE-RELATED ARTICLES!  
IF YOU DON'T SEE WHAT YOU WANT, JUST CALL ME OR WRITE.**

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**ROBERT A. HAAG METEORITES, P.O. BOX 27527, TUCSON, AZ USA 85726**  
Telephone (602) 882-8804 FAX 1-602-889-0551

Beautiful color photos by Jeff Smith Photography, Tucson, Arizona. Jewelry photography by Andre Baget.

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## Glossary

<i>Achondrite</i>	Stony meteorite without chondrules. A crystallized texture.	<i>Hypersthene</i>	Green, magnesium-iron silicate mineral
<i>Ataxite</i>	Metallic meteorite not showing structure when etched - most nickel rich of all irons.	<i>Iron</i>	Metallic meteorite; also the iron-nickel alloy in meteorites
<i>Brecciated</i>	Fragmented	<i>Kamacite</i>	Low-nickel, readily etched, bar-shaped plates in metallic meteorites
<i>Bronzite</i>	Brown, magnesium-iron silicate mineral	<i>Mesosiderite</i>	Stony-iron meteorite having discontinuous metal
<i>Chondrite</i>	Stony meteorite exhibiting round chondrules and fragments of same.	<i>Newman lines</i>	Fine, parallel twin lines in metallic (hexahedrite) meteorites, formed by shock
<i>Chondrule</i>	Small, rounded grains of silicated material.	<i>Octahedrite</i>	Metallic meteorite composed of kamacite and taenite in octahedral arrangement
<i>Diogenite</i>	Stony, achondrite meteorite composed of green hypersthene crystals.	<i>Olivine</i>	Green, magnesium-iron silicate mineral
<i>Enstatite</i>	White, creamy colored magnesium silicate mineral.	<i>Schreibersite</i>	Silvery colored, iron-nickel phosphide mineral
<i>Eucrite</i>	Stony, achondrite meteorite composed of pyroxene and plagioclase	<i>Taenite</i>	High-nickel, slowly etched ribbon-shaped plates in metallic meteorites
<i>Hexahedrite</i>	Metallic meteorite composed of kamacite and having cubic cleavage. Most nickel poor of all irons	<i>Trolite</i>	Bronzy colored, iron sulfide mineral
<i>Howardite</i>	Stony, achondrite meteorite composed of hypersthene, olivine, clinohypersthene, and anorthite. A soil mix off of an asteroid.	<i>Widmanstätten pattern</i>	Crystal structure of metallic meteorites that are composed of bottle kamacite and taenite



