

President's Message

Seasons Greetings!!

By the time you are reading this 2001 will be history. My term as President will be half over and we will be only about 5 months from the 25th Anniversary Show to be held in Calgary on May 4-5, 2002.

Some highlights of the year to date:

1. On going discussions with the CCFMS about rejoining the GMFC. Ron Shannon is representing our cause to them.
2. Show in Calgary for 2002 is well in hand and promises to be a great time. Be sure to come if you can.
3. New promotion Brochures have been prepared and will be distributed where needed.
4. 2003 Annual Meeting and show to be held in

Regina.

As I read newsletters and articles from various clubs and federations, one thing seems to keep coming up. This is the issue of land access and land use. In many cases the land where we used to collect rocks, minerals, fossils, etc, has been closed to us. Many large areas have had park boundaries drawn around them with little or no input from many of the users (rockhounds included). Other areas have been closed due to careless collectors leaving holes, gates open, trash, etc. Please take care that what we do is not the cause of some landowner deciding to close his land to collecting. Always follow our Code of Ethics for Behavior in the field. It is up to each one of us to do everything possible to maintain access to as many areas as possible. I am sorry to hear that the B.C. Society has decided to disband their P.O.R.A. committee, (Preservation of Rockhound Areas), due to the lack of interest of people to get involved in this issue. I urge each and every rockhound to make the utmost effort to protect that favourite area that they like to visit.

The By-Law Revision Committee has completed a draft of revised by-laws that will be sent to all clubs and individuals for consideration. Please watch for this document and present it to you clubs for discussion, as it will be dealt with at the annual meeting in May.

Many thanks to Ron, John and Don (wonderful alliteration!) for their hours of hard work on this important job.

On behalf of the entire executive, I wish everyone a great holiday season and a Happy New Year.

David Barclay
President

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First Vice President's Message

by John A. Hausberg, 2001-2002 First Vice President

Another New Year is fast approaching and one thing we must not lose sight of is, there is a very important milestone coming up. The 25th Anniversary of the GMFC, it is only appropriate for us to go back to where it started for a celebration. In 1977 the delegates gathered in Calgary for the Founding Convention, now you can gather in Calgary for the 25th Anniversary celebration and convention. In this issue you'll find a message from Lavern Novlan, Show Chairman, outlining some of the events planned for your enjoyment. Mark your calendar, make your reservations and plan to enter a **Competitive Display** in our show.

"Competitive Display ? You must be crazy you must be crazy to even suggest it. " If those are your thoughts then you must read on. I know that most clubs do not have competitive displays at their shows. I don't know why people shy away from competitive displays. It's not quite like the olympic games, in our competition you compete against yourself. The object is to see how close to perfect you can work a stone, piece of silver, carving, mineral specimen etc. The Uniform Rules tell you how it should be done and you do it to the best of your ability. The judges, using the same rule book tell you how well you did. Their comments will be of great help to you when preparing your next entry.

The competitors are divided into categories from "Novice to Master" it's up to you to decide where you fit in. Once you have earned a "First level" ribbon in your category you must move up to the next level. This is repeated in each Division so that you can start from Novice if you wish. To start in a higher category is not always advisable.

In order to encourage people we have two special events at each show for Novices. This is the single stone competition in "Cabochons and Faceted " stones. Earn 70 points on your single stone and you are ready to enter the three stone competition. The hosting club select the material and size for the single stone and the pattern for the faceted stone. The single stone cabochon must be cut according to the GMFC approved cutting guide. There is nothing better for the Novice than having an unbiased judge, who without knowing who's stone it is, gives his

expert opinion on the choice of material and the way the work is done.

All GMFC shows have a competitive class. This means that anyone can enter any Division, Category and Subdivision and expect his entry to be judged by qualified judges. The judges work in a team of two, they are assisted by a qualified clerk. After the judging is over the results are posted on the case. Each competitor then has the opportunity to meet the judges and get clarification on any points or comments that may not be clear to the competitor. Ribbons are awarded with "White" ribbon for Third Level Score, "Red" ribbon for Second Level Score, and "Blue" ribbon for First Level Score.

As you are getting ready for Calgary it's only fair that I give you the information about the single stone competition. Division B Sub. Div. BF 2 Single Faceted stone. Cut: Zircon cut Size: 10 mm
Material: Quartz- natural, any colour. Girdle must be polished. Division B Sub. Div. BC7 Single cabochon stone Use cutting guide. Material: Agate (any type/ any colour) Size: 30mm X 40 mm Oval. Start cutting, and "Good Luck" to you. See you in Calgary.

John A. Hausberg
First Vice President, GMFC

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Editor's Note: Please mark on your calendars that March 21, 2002 is the deadline for submissions for your next newsletter.

You Wanted To Know

by Trudy Martin & Ron Bundus

Local Club? Provincial Association? National Federation? Why do we belong? What do they do for us? What can we do for them?

Local Clubs - Why did we join? Was it to learn more about rocks and gems or was it the class we took to do faceting or to make cabochons and wanted to learn more about the hobby? Think about the things which are of interest to you. Is it the field trips, the classes, working with others on crafts or just socializing?

Rockhounds are a friendly bunch who enjoy sharing their finds and talents. Whatever your interest is, the fellowship is probably what keeps you coming back.

Provincial Association - Fine, you say! But why do we belong to those other organizations and pay dues to them? Our club draws from the expertise of members in other clubs for programs, material in our news bulletin, ideas for expanding our own skills and variety in our shows. We all feed on each other and the greater the variety of sources, the richer our meals. If you are a new member, remember it is through the work of many enthusiastic rockhounds over the years that we have the wealth of information and skills to share today.

Some of the objectives of the Provincial Association / Federation is to:

- a) encourage exploration of lapidary material, to promote finished and unfinished rocks, mineral, gemstones, fossils, artifacts and related material to create greater interest in same.
- b) promote and encourage closer association with and exchange information between rock hobbyists and lapidary groups across the country.

Their finances consist of membership dues, rock auctions, shows, etc.

GMFC National - Gem & Mineral Federation of Canada. About 25 years ago, several enthusiastic rockhounds from across Canada felt it was time to extend their relations to clubs across Canada. There is strength in numbers and there were several areas in which they felt more members would lend a stronger voice. There were many matters that were

not strictly local issues and it was felt we could help each other.

The GMFC is an umbrella organization representing clubs across Canada. It was founded in July 1977 to assist its members by various means to promote earth sciences, to protect collecting sites, to educate collectors and to foster good will, friendship and rapport among all.

The GMFC has been concerned with spreading helpful information to all members. In this area they have produced and supplied to all clubs a series of manuals. These manuals, listed in the new PR Brochure, are also available to individual members at a nominal cost.

The GMFC has Third party Liability Insurance. This protects you, the member, against claims against you for damage you may inflict on someone else's property or persons. Riders may be obtained to protect owners of collecting sites, quarries, mines, shows, etc. and against suits from members.

At present, the GMFC organization consists of 6 directors each from the BC Society and the Alberta Federation, 7 Life Members, and the Presidents of individual clubs; i.e. Yukon 1 Saskatchewan 3, Manitoba 2, Ontario 1, Nova Scotia 1 and Nunavut 1. Presidents rotate annually. There are 3 Vice presidents who move up the line. The Secretary and Treasurer are appointed each year to provide continuity.

GMFC holds annual conventions in conjunction with a Gem Show. We try to rotate these so no one Federation or Society has to host a show more than once every 3 to 5 years. The Federation Show Manual has been a big help to the clubs hosting the shows. Other meetings are held by teleconference.

Other features include -

Dealers - GMFC encourages the dealers to become members. They get their names listed in the Directory which goes to all clubs, directors, libraries, museums, etc. You, the members, are encouraged to support the dealer members.

Newsletter - The GMFC Newsletter, published 3

times a year, is sent to all clubs, (1 copy for each 10 members), dealers, individual members, libraries, etc. Members are urged to read and share the newsletters.

Newsletter Competition - To encourage editors and, through the score sheet, to offer suggestions to assist them. Editors are urged to join SCRIBE an organization OF and FOR editors.

Directory - A directory listing all GMFC officers, directors, individual members, societies, federations, clubs and dealer members is sent to all agencies listed above in the fall, following the annual meeting.

Education - Education programs are available through the GMFC and the provincial federations. i. e. children's programs, identification program, slides, videos, etc.

GMFC members adhere to a Code of Conduct for Canadian Collectors respecting the earth sciences.

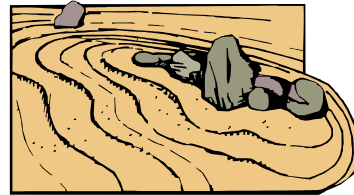
GMFC is open to suggestions to enhance and improve the organization, thereby benefiting all

members.

Belonging in this fast changing world, which is becoming more restrictive to rockhounding activities, is a necessity. Each club needs its membership in the broader based association and federation to facilitate exchange of ideas and information and to have a platform to add its voice to the concerns that affect all rockhounding in whatever area your interest lies. Let us make sure we do not lose this.

Adapted from articles by
Alice Clarke 1993 & Marlyn Bundus 1994

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Come to Calgary in May 2002 and help celebrate the 25th Anniversary of the Gem & Mineral Federation of Canada.

On behalf of the Calgary Rock and Lapidary Club (CRLC) and the Show Committee, I would like to invite you to the 25th Anniversary of the founding of the Gem & Mineral Federation of Canada (GMFC) which took place in Calgary, in 1977. The first GMFC show was held in Vancouver in 1978. This is also the 42nd Annual show for the CRLC.

The Show Com. and club members are hard at work in order to make the Convention and Show a great success.

We would like to make this a reunion for Present and Past Directors of the GMFC. Our Show Com. is preparing a great reunion for you. We feel certain that you'll enjoy your time in Calgary as you renew your acquaintances. A number of events have been planned for you. A detailed package will be mailed

to your club, it will contain information and answers to all your questions. Rooms have been booked, RV parking reserved and space is still available for you to display at the show. If you would rather just demonstrate we can handle that to. For further info call Trudy Martin 403-287-1570 < or John Hausberg 403-240-4514 <

We are looking forward to seeing you at the show.

Lavern Novlan
Show Chairman.

V

Karst in British Columbia

What is Karst?

Karst is a distinctive topography in which the landscape is largely shaped by the dissolving action of water on carbonate bedrock (usually limestone, dolomite, or marble). This geological process, occurring over many thousands of years, results in unusual surface and subsurface features ranging from sinkholes, vertical shafts, disappearing streams, and springs, to complex underground drainage systems and caves.

How Karst is Formed

The process of karst formation involves what is referred to as "the carbon dioxide (CO₂) cascade." As rain falls through the atmosphere, it picks up CO₂ which dissolves in the droplets. Once the rain hits the ground, it percolates through the soil and picks up more CO₂ to form a weak solution of carbonic acid: H₂O + CO₂ = H₂CO₃. The infiltrating water naturally exploits any cracks or crevices in the rock. Over long periods, with a continuous supply of CO₂-enriched water, carbonate bedrock begins to dissolve. Openings in the bedrock increase in size and an underground drainage system begins to develop, allowing more water to pass, further accelerating the formation of karst. Eventually this process leads to the development of subsurface caves.

Distribution of Karst in British Columbia

British Columbia is blessed with an abundance of world-class karst, particularly in the Rocky Mountains and on Vancouver Island. Other areas of karst development occur on the Queen Charlotte Islands, along the coastal mainland, in the interior mountain ranges, the Cariboo Mountains, and in northwest BC.

The Rocky Mountains contain the most extensive areas of soluble rock in the province, as well as Canada's longest and deepest documented caves. Subsurface drainage systems, springs, and surface features, such as sinkholes, are common throughout the Rockies, with some of the most notable karst terrain occurring on plateaus as high as 2000 metres.

The full extent and significance of karst in the Rocky Mountains and other parts of the interior are not well understood. Isolated locations, limited ground access, and extreme winter climates have made the

exploration and documentation of interior karst lands difficult.

More is known about BC's coastal karst, particularly on Vancouver Island. The high concentration of karst features on Vancouver Island, combined with a long history of cave exploration and the unique association of karst with the coastal temperate rain forest, has focused a great deal of international attention on these coastal forest karst ecosystems.

Coastal Forest Karst Ecosystems

Several environmental factors favour the development of karst on BC's coast:

- geology--large units of very pure carbonate bedrock,
- heavy rainfall--a plentiful and steady supply of water,
- steep topography--creates higher energy sinking stream systems for underground drainage development,
- tectonic activity--uplifting, tilting, faulting, and folding limestone beds cause weaknesses and fractures in the rock for exploitation by infiltrating water,
- vegetation cover--extensive forests provide a high level of organic matter, increasing CO₂ in the soil as it decomposes,
- glacial history--deglaciation released great quantities of water to dissolve susceptible bedrock.

Most of the karst on the coast occurs within the coastal western hemlock bio-geoclimatic zone where the major tree species are western hemlock and amabilis fir, with some western red cedar, Sitka spruce, and yellow-cedar. These coastal forest karst ecosystems are often characterized by large mature trees, diverse plant and animal communities, highly productive aquatic systems, well developed subsurface drainage, and extensive surface karst and underlying cave resources.

Coastal forest karst ecosystems are commonly more productive than similar forest sites on nonkarst terrain. This increased productivity can be largely attributed to well-drained soils and the nutrient cycling associated with karst. As carbonate bedrock is dissolved by penetrating water, it releases CO₂, calcium carbonate, and micro-nutrients into the soil, encouraging plant growth and development. The

level of productivity appears to be directly related to the extent of surface and subsurface connections.

Plant and Animal Habitat

Karst ecosystems often support unusual or rare plant and animal species, both on the surface and underground. Certain species of ferns and mosses prefer or, in some cases, require a limestone substrate on which to grow. Other fern species have adapted to growing in the cool, moist twilight conditions of cave entrances.

Many wildlife species use various karst features for habitat. Caves are used intermittently by large carnivores for shelter or resting. Birds and small mammals, such as woodrats, often nest in caves and other cavities. Elk and deer commonly bed down in the vicinity of cave entrances during summer when the air from caves is cooler, and during the winter when cave air is generally warmer than surrounding temperatures. Caves, and their stable environments, can be critically important habitat for bat species that depend on them for roosting and hibernation.

Some karst-dependent species, known as troglolobites, have evolved to living exclusively in the total darkness of caves. In BC, the only troglolobite identified to date is a freshwater crustacean found in underground pools in caves on Vancouver Island. More common are troglolophiles, which are species found living both inside and outside caves. Some individual troglolophiles may complete their entire life cycle within a cave, while other members of the same species live their lives outside caves. Examples of troglolophiles in BC include certain species of salamanders, spiders, and crickets.

Aquatic Systems

Research conducted in southeast Alaska suggests that karst stream systems play a significant role in the productivity of downstream aquatic habitat. The research indicates that karst can increase fish productivity in the following ways:

- the leaching of calcium carbonate from bedrock has important buffering effects on acidic streams,
- the groundwater associated with karst results in cool, even stream temperatures throughout the year,
- the storage capacity in karst stream systems buffers seasonal flow rates to produce lower peak flows and higher low flow periods,
- karst streams tend to supply more nutrients and encourage more algae and moss growth, aquatic insect populations within karst streams are larger and more diverse, karst stream systems provide

more protective sites for fish to rest, breed, and avoid predators.

In addition, karst aquifers contribute to human water supplies in many parts of the world. Although relatively little is known about BC's karst groundwater systems, it is likely that they too play an important role in some community watersheds.

The subsurface drainage systems of karst lack many of the natural cleansing and filtering mechanisms of surface streams. As a result, harmful substances or materials introduced into karst can lead to excessive soil erosion, destruction of surface and subsurface karst features, changes in groundwater flows, and contamination, sedimentation, or clogging of underground and surface streams.

When conducting forestry operations in forest karst ecosystems or associated upland areas, extra care must be taken to ensure that karst values and forest productivity remain intact. Recreational pursuits in karst terrain also need to be monitored and managed to protect the resource from overuse or other damage.

Management of Karst Resources

In British Columbia, the responsibility for managing karst resources in provincial forests lies with the Ministry of Forests. Under the Forest Practices Code, several provisions have been made for managing sensitive areas such as karst. The Code requires identified sensitive areas to be treated in a way that protects or conserves special resource values. To accommodate some of the unique requirements of managing karst, the ministry is developing interim karst management guidelines that will provide direction on managing forestry and recreational activities in karst landscapes.

The guidelines will address road construction and maintenance, timber harvesting, reforestation, and stand tending practices, as well as recreation issues such as site and trail selection, access, and commercial opportunities. Options for suitable activities and management objectives, including preservation, will be included in the guidelines.

Once completed, the interim karst management guidelines will be field tested and revised as necessary. The final guidelines, once approved, will be integrated with existing regional cave management guidelines and incorporated into a comprehensive Forest Practices guidebook addressing all aspects of karst and cave management.

To facilitate this process, the ministry is developing educational programs on karst management to raise the awareness of karst issues to Forest Service staff, the forest industry, and the public.

Suggested Areas for Viewing Karst and Caves in BC:

Vancouver Island

- Home Lakes Caves Provincial Park near Qualicum Beach
- Upana Caves Recreation Site near Gold River
- Little Hustan Caves Regional Park (south end of Nimpkish Lake)
- Karst Creek Trail in Strathcona Provincial Park

Interior

- Cody Caves Provincial Park near Nelson
- Nakimu Caves in Glacier National Park
- Top of the World Provincial Park near Canal Flats

- Kakwa Provincial Park near Prince George

For more information on karst, please contact:
Forest Practices Branch
Ministry of Forests
1st Fl., 1450 Government Street
Victoria, BC
Phone: 250-387-6656

Mailing address:
Forest Practices Branch
Ministry of Forests
PO BOX 9513 STN PROV GOVT
Victoria, BC VBW 9C2

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Minutes of the Teleconference of the Gem & Mineral Federation of Canada,

Alberta: John Hausberg, Bob Findley, Peter Meyer, and Lavern Novlan

BC: Dave Barclay, Alice Clarke, Elmer Clarke Ken Dewerson, Maureen Wade, and Don Rotherham

Saskatchewan: Ron Bundus, Don Fabrick, Darlene Itcush

Ontario: Ron Shannon

CALL TO ORDER – David Barclay called the meeting to order and welcomed all present. In the interest of time continued with the meeting.

APPROVAL OF AGENDA – Dave asked if there were other changes than as set out in the circulated agenda. Maureen had a new item regarding articles for newsletters to be brought up under New Business. Moved, seconded. CARRIED.

SECRETARY'S REPORT – Maureen Wade
Asked if there were any errors or omissions in the Annual Meeting Minutes of June 13, 2001.
Corrections are:

1. Page 9 "Their Directorship commences in 2001 at fiscal year changeover."
2. The letterhead with the directors correct positions and information which had already

been done.

3. There being no further errors or omissions moved by Minutes be accepted with corrections.

CARRIED.

TREASURER'S REPORT – Ken Dewerson
Financial Report -- As at Sept 7,2001 the bank balance was \$4,441.43 and all bill currently paid.
CARRIED.

MEMBERSHIP/DIRECTORY/SUPPLIES – Alice Clarke.
Alice gave her report and it was accepted and carried.

PUBLIC RELATIONS – Ron Bundus.
The new GMFC brochures are done. They have been sent to the other committee members. It was moved and seconded that the new brochures be printed and sent out to the clubs. Moved by Bundus/Wade to accept report as given. CARRIED.

NEWSLETTER -- Mark Curtis.
No Report was forwarded.

NEWSLETTER –

Trudy was not on line. Report read by John Hausberg

EDUCATION — John Hausberg

This Chair is filled by Peter Meyer. Peter has not received the records to date but has been assured that he will receive them in the near future. There is no report at this time.

FIELD TRIPS - Elmer Clarke.

Elmer has not received any information regarding field trips. There was a discussion on the role of the GMFC in connection with field trips. It was concluded that the GMFC could not host field trips but would act as a co-ordinator for the provinces. Therefore all information is to be forwarded to Elmer for the next teleconference. CARRIED.

INSURANCE – No Chairman

Dave Cole, a director from Alberta who has been an Insurance person has agreed to take this chair. It was moved and seconded that Dave Cole take over the Insurance Chair. CARRIED

HISTORIAN – Margaret Lowe

Margaret was not on line and there was no report.

GMFC SCHOLARSHIP FUND -- John Hausberg

John reported on the scholarships. All recipients have received their monies. Pictures were taken and would be forwarded for the Photo Album. CARRIED.

2002 SHOW REPORT – Lavern Novlan

All preparations are progressing well. A list of demonstrators is needed. Any suggestions for demonstrators to be forwarded to Paul Milo, 403-277-4243, pmilo.cadvision.com. Up-dated report will be put in the GMFC Newsletter.

REPORT CARRIED.

2003 SHOW –

The 2003 GMFC Show will be held in Regina and hosted by the Prairie Rock & Gem Club. The contact person for this show is Darlene Itcush , 306-545-3405, itcush2@sk.sympatico.ca

2004 SHOW – TBA

2005 SHOW -- TBA

COOKBOOK — Victoria Garlinski

According to the report submitted by Victoria, the Cook Book will be completed by November 30th, 2001.

CCMFS – Ron Shannon

Ron reported on the progress of discussion with the CCMFS. It was requested by the CCMFS that someone sit in on their ad hoc committee meetings. It was moved and seconded that Ron Shannon attend these meetings and speak on behalf of the GMFC. Carried. Ron requested a list of reasons, pros and cons for the CCMFS joining the GMFC. There was further discussion on this after the regular meeting.

By-law Review Committee- Don Fabrick, John Hausberg, Ron Shannon

Don, John and Ron have been very busy and progressing well with the review of the by-laws. They reported that they will be completed in time for a review before the next teleconference.

Old Business-

New Business-

Suggested by Maureen that articles be written by the appropriate people and sent to club newsletters so the readership is expanded and the information is explaining :

1. What the GMFC is and the function to the individual club member.
2. Hierarchy- The line from club member to GMFC.
3. Insurance
4. Scholarships

These articles must be written in an easy read manner so the individual members can understand things like how to apply for a scholarship, etc. It was agreed that this would be done.

There being no further business to discuss Dave Barclay closed the meeting.

The next teleconference to be arranged by Don Fabrick and be held on February 24, 2002 at 1:PM Alberta Time.



The Hardness of Rocks and Minerals

by Dr. Bill Cordua
University of Wisconsin-River Falls

Hardness tests of minerals are among the easiest and most useful tests to perform. What rockhounds speak of as hardness is more accurately described as resistance to abrasion. We are testing how easily one substance will scratch another. As an example, copper is relatively easy to scratch, but would you bet on diamond or copper standing up better to blows from a hammer? Hammer blows measure the ease with which something fractures or its tenacity. There are other hardness scales than are based on ease of indentation, resistance to twisting and so forth. For the sake of simplicity and standard usage, in these articles, hardness will refer to the resistance to abrasion as given by Mohs' Scale.

The classic scale for hardness was published in 1822 by Frederick Mohs, an Austrian mineralogist who got the basic concept from scratch tests performed routinely by miners. Since Mohs published the scale, it bears his name rather than that of the unknown genius who thought of it. The scale selects 10 minerals as standards, arranging in order of increasing hardness. These are, as most of you probably know:

- 1 = Talc
- 2 = Gypsum
- 3 = Calcite
- 4 = Fluorite
- 5 = Apatite (fluorapatite)
- 6 = Orthoclase
- 7 = Quartz
- 8 = Topaz
- 9 = Corundum
- 10 = Diamond

These minerals were selected for their abundance, as well as their differing hardness. The scale is uneven. For example, diamond at 10 is much harder than corundum at 9, while fluorite at 4 is only slightly higher than calcite at 3.

A more limited but practical scale can be easily and cheaply obtained by observing your fingernail has a hardness of 2.5, a penny has a hardness of about 3.5, glass and a steel nail have nearly equal hardnesses of 5.5 and a streak plate has a hardness of 6.5. If I carry a nail and streak plate with

me and can scrounge up a penny, I've got a handy, light weight mineral testing lab in my pocket.

More expensive sets can be bought. A set with small samples of all of Mohs' minerals allows a bit more precision in testing. The specimens do lose their usefulness the more they are scratched up in various tests. As an alternative, one can custom build their own Mohs set through collecting or purchasing small fragments of the needed minerals. Other vendors provide sets of hardness pencils with tips of two natural or artificial substances of measured hardness. These are handy in that they are very precise and allow one to test a small surface easily.

Most mineralogy texts give tables of mineral hardness. Particularly complete and useful tables appear in John Sinkankas' "Gemstone and Mineral Data Book."

Doing hardness tests requires some technique. You need to find a good surface or edge on your unknown to test. Take care to make sure you are testing the right grain - not the bit of quartz right next to it. In some case it is easier to scratch the unknown across the standard. (the point of a unknown mineral grain across a calcite cleavage). In other cases it is easier to test the standard across the unknown (tip of a nail across cleavage surface of the unknown grain). In an ideal case, you should try to do both, to double check your findings. You need to press hard enough to good effect, but not so hard as to fracture either sample. Practice will help you get the proper level of stress to exert.

As a result of your test, you will look for a scratch. Rub aside any powder to see if a distinct scratch has been left. Calcite will leave a trail of powder across quartz. Rub away the powder and you'll see the quartz is unharmed. A hand lens will help you see the scratch. In this way you can bracket the hardness of your unknown between two of your standards (harder than a fingernail, softer than a penny). The ease with which one substance scratches another is also useful. Quartz easily scratches calcite, telling you of a large hardness difference. Quartz will scratch feldspar with much

more difficulty. When testing a standard against an unknown that is of equal hardness, both substances will leave shallow scratches on each other.

The hardness of a particular mineral may vary with direction within the same grain. Kyanite is a good example. Kyanite generally occurs in long bladed crystals. The hardness taken the short way across the blade has a hardness of 7 the hardness taken the long way along the same grain will be 4.0. Muscovite is another good example of this. Its hardness is 2.5 when taken across a the flat surface of a cleavage sheet, but 4 when taken across the grain of a book.

The reason hardness varies in this way is that the phenomenon depends on the strength of the bonds holding the mineral together. The bond strength can be significantly different in different directions in the mineral, giving the different hardness. In most minerals this difference with direction is minor and doesn't affect the test. In the case of kyanite, this difference in hardness is a confirming test by itself.

Some minerals' hardness may vary from sample to sample depending on that mineral's exact chemical composition. Hornblende's hardness can vary from 5 to 6, meaning some hornblende is softer than glass, some harder. This reflects the fact that hornblende can accommodate varying amounts of sodium, calcium, iron and magnesium in its structure, which affect the details of its chemical bonding, hence its hardness.

Testing the hardness of rocks is less effective than testing the hardness of minerals. A rock is basically a mixture of various minerals, although it can contain non-mineral materials such as natural glass and fossils. (Fossils aren't minerals because they are organic, while glass isn't a mineral because it lacks an internal crystalline structure). Let's take a granite pegmatite for example. This might contain grains of topaz (H=8), quartz (H=7), feldspars (H=6) and muscovite mica (H=2.5). You could thus get a range of hardness depending on which grain you tested. In a coarse grained rock, identifying the individual minerals allows you to identify the rock. If the rock is fine-grained, it's harder to interpret the results.

The hardness of fine-grained rocks tends to reflect the average hardness of the minerals in them. Shales are made mostly of clay and tend to be soft. Limestones and dolostones are also soft, with a hardness of 3-4. Just watch out if quartz sand is present mixed with the carbonates! Quartzite and

chert being made mostly of quartz are both very hard. The hardness of sandstone may be difficult to test. If the sand grains have not been cemented well or have been cemented by calcite, the sandstone will seem softer. The individual quartz sand grains will still have a hardness of 7, but the rock may crumble or disaggregate in your hand, making it look soft. If you think it is really soft, trying dragging the disaggregated sand grains across a piece of glass and you'll readily see the effects. Most igneous and metamorphic rocks contain much feldspar, quartz, pyroxenes and amphiboles. Their hardness is thus going to be between 6 and 7. This means hardness is not a good way to distinguish one of these rocks from another. Volcanic glass will typically have a hardness of 5.5 - 6.0 depending on its particular chemical composition.

The hardness of rocks and minerals is also dependent on the degree of weathering. Weathering may convert feldspars (H=6) to clay minerals (H=2 - 3) Even corundum (H=9) can alter and have rims of softer minerals such as margarite (H= 3.5-4.5) around it. This is why it is important to test as fresh or unweathered a surface as you can while doing hardness tests.

Mohs' scale has stood the test of centuries as a useful tool for mineral identification. Its simplicity and effectiveness will likely assure its relevance well into the future.

Dr. Bill Cordua
william.s.cordua@uwrf.edu
<http://www.uwrf.edu/~wc01/welcome.html>

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Feldspar

by Anita D. Westlake. libawc@emory.edu

Originally Presented to the Georgia Mineral Society's Mineral Section Meeting

The word feldspar literally translates to: feld, meaning field, and spar, meaning "easily cleaved material". It refers to any of several crystalline aluminosilicate minerals found in abundance in the earth's crust.

Minerals in the feldspar group are found in many places throughout the world, in pegmatites, even meteorites, and pass through all rock and ore-forming processes: igneous, metamorphic, hydrothermal and sedimentary, yet only rarely do they occur as gemstones. Feldspars are the most diversified and the most extensively investigated minerals on earth, though they only recently commanded the attention they deserve. It wasn't until the middle of the eighteenth century that minerals in this group were even vaguely mentioned in Wallerius's popular work "Mineralogy" written in 1753. They were briefly described as varieties of a "spar dense and lustrous" distinguished only by their colors of white, gray, and the occasional red. It wasn't until the end of the 18th century that serious crystallographic and chemical research began. Today, at least 40 varieties of feldspars have been identified, with a dazzling array of colors and distinctive features.

Feldspars have a specific gravity which varies between 2.5 to 2.7 depending on the chemical composition. The hardness ranges from 6 to 6.5. Its fracture, other than along the cleavage planes, is subconchoidal to uneven. Most feldspars crystallize from a melt in igneous rocks. Their crystals are tabular, flattened and most are complexly twinned.

All feldspars have certain physical characteristics in common: they have 2 good easily developable cleavages, one which is perfect, usually known as the basal plane. Here, the luster is pearly and the from the cleavage cracks parallel to this face, brilliant iridescent colors are sometimes reflected. The second cleavage, less perfect than the first, is parallel to the pair of faces which truncate the acute sides of the prism. The cleavages of monoclinic and triclinic feldspars are essentially the same with the following exception: the monoclinic crystals have cleavage planes that are exactly perpendicular to

each other, giving them the name "orthoclase" which means "cleaving at right angles." In triclinic feldspar, the two cleavage directions are not quite at right angles. These are referred to as "plagioclase", meaning obliquely cleaving.

The presence of lamellae, which are thin, platelike layers within the crystalline structure, gives rise to the "Schiller Effect". This is an iridescence caused by the scattering of light between the layers. In Labradorites, the Schiller Effect is best developed, creating a lovely color play in shades of green, blue, gold and yellow. The color may be homogeneous or vary within a single feldspar crystal. Research is currently being conducted on lower quality plagioclase feldspar mined in Arizona to see if gamma radiation will produce a color shift or enhancement. Initial tests suggest this possibility exists.

POPULAR STONES IN THE FELDSPAR GROUP

AMAZONITE



CRYSTAL SYSTEM: Triclinic

HARDNESS: 6

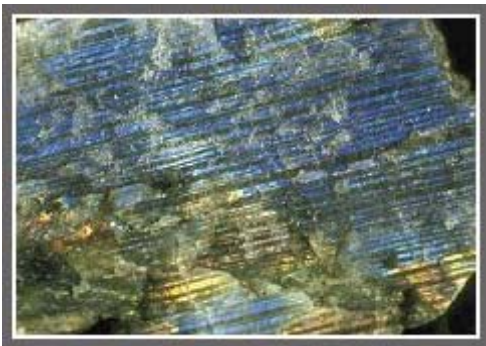
COLOR: Light green, blue-green or bluish with a mottled appearance and sometimes a fine crisscross network of light striations (which help to distinguish it from certain jades and beryls.)

Originally called "Amazonstone" because it was found near the Amazon River, this term was also used to describe Nephrite.

GENESIS: It is found in metamorphic rocks, intrusive magmatic rocks and pegmatites. The finest examples of Amazonite in the United States are found in Amelia Courthouse, Virginia. Pikes Peak, Colorado also boasts a variety of Amazonite found in cavities in a coarse pegmatite granite with smokey quartz crystals, often of huge size.

LORE: Worn by gamblers to attract money. It was also used by anyone taking a chance to ensure success.

LABRADORITE



CRYSTAL SYSTEM: Triclinic

HARDNESS: 6-6.5

COLOR: Blue, green, yellow are the most common colors, with copper-red being the most rare.

The most magnificent of all the feldspars, Labradorite occurs on the coast of Labrador, Canada. Although it is often a dingy, dark gray, the brilliant play of colors and unexpected flash combine to make this a most remarkable stone. It is a lime-soda-feldspar, comprised of approximately 55% silica, 25% alumina, 2% ferric oxide, 11% lime, 4% soda, with a touch of Potash. Feldspars with this composition are referred to as Labradorite, whether they come from Labrador, Madagascar, Scandinavia, or the United States.

The stone is cut, not with facets, which would destroy its reflected rays of color, but either perfectly flat or with a slight convex surface. It must be cut parallel to the reflecting surface, or no play of color will be seen. The sudden appearance and disappearance of brilliant colors is its most striking feature and gives us the word "Labradorescence".

An interesting specimen of Labradorite from Russia displays a perfectly recognizable image of Louis 16th. The head is of the finest azure-blue and stands out from a golden-green background. It is topped by a beautiful garnet-red crown with a

border of rainbow colors and a small, silvery shining plume. In 1799 the owner received one quarter of a million francs for it.

It was customary to use Labradorite in the representation of objects with a metallic color such as the iridescent wings of butterflies. In the beginning of the 19th century, reliefs of Mandrill baboons were very much in vogue, and Labradorite was used to color the snouts of these most colorful animals.

GENESIS: Widely distributed throughout the United States, it is found in great abundance in Lewis and Essex Counties in New York in situ as boulders in glacial deposits. These boulders can be traced all the way down to Long Island and New Jersey, and were so numerous in one river in Lewis County, it was named "Opalescent River". Large quantities were quarried at Keesville, NY for monumental and building purposes. It is found in Pennsylvania, Arkansas and North Carolina, but the gem quality variety is only found in Labrador, Canada and Finland.

LORE: In ancient times, Labradorite was considered a general "good luck" stone. In recent times, it has become popular among New Age devotees as a spiritual, psychic-enhancing gemstone.

MOONSTONE

CRYSTAL SYSTEM: Monoclinic

HARDNESS: 6

COLOR: Almost colorless, tinged with yellow, whitish to silvery white with a blue shimmer.

Moonstone refers to the colorless, translucent, or almost perfectly transparent feldspar which in a certain direction reflects a bluish, milky light that has been compared to the light of the moon. It has also been called "girasol", "fish-eye", "wolf's-eye", "Ceylonese Opal" and "Water Opal". Very good glass imitations of moonstone are frequently used in expensive jewelry. These "fakes" are denser and less hard, and are only singly refracting, whereas real moonstones are distinctly doubly refracting.

GENESIS: The best moonstone is found in Sri Lanka, and is often referred to as the "National Stone of Sri Lanka". It is collected by hand by miners who dig deep, narrow holes in the earth. They lower themselves by rope to the bottom of these pits, fill their wicker baskets with loose dirt and gravel, and hoist the baskets up to the surface. It is then washed by hand and the gem quality

moonstones are picked out of the gravel. The finest specimens in North America come from Allen's Mica Mine in Amelia Courthouse, Virginia.

LORE: It is said to counteract the negative influences of the number 13. Amulets of moonstone were hung in fruit trees to produce abundant crops. It was thought to protect against wandering of the mind, insanity and epilepsy. It was attributed to improving physical strength and reconciling lovers. If held in the mouth, a moonstone was supposed to help decide matters. It was even used to hypnotize people. In the Orient, moonstone was believed to be the solidified rays of the moon, and the glimmering light within was the light of the good spirit that lived in the stone. Occasionally, under magnification, a peculiar flaw appears: a long inclusion resembling a centipede.

NOBLE ORTHOCLASE



CRYSTAL SYSTEM: Monoclinic

HARDNESS: 6

COLOR: Mid to golden yellow, it is perfectly transparent with a vitreous luster. Noble Orthoclase is most commonly faceted into a "Step Cut" and the gems are usually free from inclusions.

A somewhat rare variety of transparent orthoclase, Noble Orthoclase is nonetheless not considered valuable. It is sought by collectors and connoisseurs for their collections but is virtually unknown to the casual gem collector.

GENESIS: It is mainly found in pegmatites in Madagascar.

SUNSTONE

CRYSTAL SYSTEM: Triclinic

HARDNESS: 6-6.5

COLOR: Specimens are commonly colorless or straw-yellow, but some rare crystals have areas of red and/or greencoloration. These vary from pale to

intense and may contain zones of red, green, schiller or any combination of the three. The schiller consists of round, thin, extremely reflective platelets that are opaque to dark brown. Inside the crystal they appear pink but near the surface have a white, metallic reflection.

Known for their transparent, gemmy quality, sunstones at one time were believed to contain metallic copper. Very thin scales of hematite are arranged parallel to the direction of perfect cleavage. The glittering sheen of the sunstone is due to the reflection of this brilliant red metallic light from the surface of these scales. At the beginning of the 19th century, sunstone was considered a great rarity and was priced accordingly. Only a few small pieces were known, and they came from Sattel Island in the White Sea.

GENESIS: Sunstone is found in a basalt flow near the Rabbit Hills in Lake County, Oregon, as well as Siberia, Norway, and Statesville, North Carolina. A rare variety of green sunstone is found in Media, Pennsylvania.

LORE: No myths or folklore can be found in past history regarding the sunstone, but current New Age thought links it to protective energy. It is said to lend extra physical energy in times of stress or ill health.

CONCLUSION

Feldspar, in all its chemical compositions, habits and colors, is a fascinating mineral group to study and collect. In its most mundane usage, it is ground up for a polishing agent in toothpaste. In its highest and most noble form, it is faceted as a rare and beautiful gem. It is at once simple and sublime. Ralph Waldo Emerson once wrote: "A man is like a bit of Labrador Spar, which has no luster as you turn it in your hand until you come to a particular angle, then it shows deep and beautiful colors."

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Pyrite, Some Little-Known Facts

by Holly Camp
Georgia Mineral Society, Inc.

I'm a "Green" person. I love the color! So, how is it that pyrite is one of my favorite minerals? I have more pyrite specimens than I have malachite, emerald, diopside and tsavorite combined. Now, that's saying a lot! Instead of what the average mineral book could teach you, I would like to tell you about some unusual information I have learned about pyrite.

The ancient Greeks called it 'pyr' which means fire and 'ite' which means stone. 'Pyrites lithos' refers to the "spark produced when iron is struck by a lump of pyrite." If you try this experiment at home, please don't use a good specimen. Remember, pyrite is brittle.

While you're at it, why not check to see why a pyritohedron is so special and why pyrite pseudomorphs turn into limonite.

Surprise! Pyrite is in the Pyrite Group. There are only five other minerals in that Group. Some of them are very strange. Penroseite is only found in Bolivia and England. Sperrylite is extremely rare because it's the only known compound of platinum. Laurite contains ruthenium (atomic #44 on the Chart of Elements) and is only found in South Africa, Canada, Sierra Leone, the former USSR, the United States, and Borneo. Bravoite is a nickelian pyrite. Just for

fun, go ahead and look up these minerals and see just how odd they really are.

Compare their specific gravities and Mohs hardnesses. Go on! It's worth it! Pyrite, an iron sulfide, and hauerite, a manganese sulfide, seem tame in comparison to the rest of this Group.

If you have been to Graves Mountain and the Little Bob Mine in Georgia, then you know about the problems associated with pyrite. When this combination of iron and sulfur (FeS₂) weathers, the iron oxidizes (rusts away) and the sulfur combines with rain and ground water. The result of that is sulfuric acid. You can even smell it. And, be careful not to kneel down there. It will eat through your jeans in no time. I speak from experience.

For a moment, think about all the people who thought pyrite was just "Fool's Gold". How little they knew! Did you know that gold, real gold, is found in most pyrite deposits around the world? If it's a major pyrite deposit and if there is a large enough percentage of gold, then it may be mined for its gold content, as well as iron and sulfur.

However, pyrite has a much more important use! More important than gold? Oh, yes. Our lives would be totally different without this one thing made from

pyrite: **SULFURIC ACID**. I know you're wondering why. Did you know that sulfuric acid is the second most important industrial chemical (water is first). This acid was first produced around 1000 AD. Here is a short list of where it is used today: in petroleum refining, as a drying agent to remove water from sugars and starches, superphosphate fertilizer, alcohol, rayon, nitric acid, paints, dyes, explosives, detergents, paper pulp, lead/acid batteries, rubber, pharmaceuticals, metallurgical processes, cellophane, and pesticides. You can even thank pyrite for the brown color of your beer bottle.

Close to home, a perfect example of the importance of pyrite (and its 'cousin' chalcocopyrite) is found in Ducktown and Copperhill, Tennessee. Originally, the mines were opened to extract copper and iron. Eventually, copper became too expensive to mine there, so the real value of the pyrite was realized. Pyrite was mined there and processed into sulfur and sulfuric acid until 1987.

But, it's the different "looks" of pyrite that captivate me. Just remember, strange things can occur as these crystals are forming. We most commonly see

the smooth-sided or striated-sided cubes. Pick one up sometime and really examine it. I can tell you're interested. Now, open a book on minerals and take a look at some of the other crystal forms of pyrite. You're blood-pressure just went up a notch. Take a look at the "penetration twins" from Spain. These pieces are dissolved out of the native limestone. This is just the way they formed! It looks like an artist worked on them to 'stand' that way. Feeling weak-kneed yet? And, then, there are "Suns". These occur as the dissolved pyrite starts to drip down through layer after layer of shale, it forms concentric "puddles", also known as "Suns". There has been much discussion lately as to whether these are more pyrite than marcasite. Time will tell and so will the experts.

If you collect pyrite, either by the "pick-it-up-yourself" or "green collected" method, you will also fall for this normally brassy yellow mineral. Just wait until you see specimens that are tarnished!

Found on the internet at:
<http://www.gaminal.org/pyrite.htm>

Damascus Steel's Last Secret Found

by Jeremy Manier

For hundreds of years, some of the keenest minds in science sought in vain to tap the secret of how blacksmiths in ancient India and the Middle East fashioned a supremely tough metal known as Damascus steel.

Legend had it that the metal, stronger and sharper than some steels produced even in industrial times, may have helped Islamic armies repel European crusaders with inferior weapons during the Middle Ages.

The search for the shimmering alloy may now be at an end, thanks to an unlikely alliance between a materials science professor at Iowa State University and a Florida blacksmith who crafts shoes for race-horses.

Their apparent recovery of the lost technology just might aid modern steelmakers in the hunt for new steels to make lighter automobiles and tougher engine components, experts said.

The work already has revealed much about the original Damascus steel, prized for its distinctive

wavy surface that Persian poets likened to ant tracks or rippling water. Islamic artisans used it for centuries to make swords that spurred envy and myths among Europeans--including the legend that a Damascus blade could slice a falling silk scarf in midair.

But finding what some experts call the Holy Grail of metallurgy took the professor and the blacksmith on a quest that spanned decades. Some of the keys to forging the stubborn metal now appear tantalizingly simple, such as a trace impurity that proved crucial after the team ignored it for years.

"If you just keep at something like this, beating your brains out, eventually you can figure it out," said John Verhoeven, the Iowa State professor. "But it took us an embarrassingly long time to do it."

Cracking the puzzle brought the unaccustomed title of scientific pioneer for Al Pendray, the blacksmith who is a former rodeo wrangler.

"A lot of people said it's rare that a so-called country blacksmith could sit down and work with a top met-

allurgist," Pendray said. "The two of us together got to the answer."

Controversy has tempered their triumph, in the form of a running feud with researchers at Stanford University who believe they re-created the old metal using modern rolling mill techniques.

Yet even their rivals concede Verhoeven and Pendray are the first to recapture both the external beauty and microscopic structure of genuine Damascus blades.

"This technology has been lost for about 200 years," said Ben Bronson, curator of Asian anthropology at the Field Museum of Natural History in Chicago and an expert on Damascus steel. "A real driving force in the development of modern steels was the attempt to replicate ancient Indian and Middle Eastern steels."

Steel not made in Damascus

Early descriptions of the metal date at least to the 1500s, but many scholars believe Muslims from Egypt to India used it for hundreds of years before that. Western traders encountered the steel in the Syrian capital of Damascus, though there is no evidence it was ever made there.

The silk scarf legend comes from the 19th Century English writer Sir Walter Scott, whose fictional tale of the Crusades described the Islamic army's swords as being "of a dull blue color, marked with ten millions of meandering lines." The hallmark pattern became known as damask, or damascene.

Europeans' interest in copying the steel grew around 1800, just as the art of making it was vanishing in the Islamic world.

The original artisans did not leave complete instructions for making their steel, and the few written formulas are less than helpful. Some advise quenching the red-hot blade in the urine of a red-haired boy or of a goat fed nothing but ferns. Another text suggests driving the sword into the belly of a muscular slave.

Chemical tests in the last century began to reveal the swords' composition but only deepened the puzzle of their manufacture. The enigma of Damascus steel boils down to finding a way of making steel that is high in carbon but not so brittle as to be useless.

Verhoeven began testing techniques in the early

1980s, still beguiled by a mystery he had stumbled across as a student decades earlier. But after years of trying to do the job with a modern rolling mill, he decided that a key might be forming the metal by hand, with a hammer.

Before long, Verhoeven had found Pendray--a blacksmith who had also taken an interest in weapons--and the two men were launched on their mission.

While Verhoeven schooled Pendray on experimental methods and had him read advanced metallurgical texts, the blacksmith gave the professor a tutorial in the art of steel forging.

"Sometimes rd have to tell him, 'I don't care if you've got a PhD, you don't understand what the hell's going on here,'" Pendray said.

To make the steel, the men used ingredients resembling a witch's brew--glass chips, iron, oyster shells, green leaves and charcoal for carbon.

The work went slowly. They spent a year just figuring out how to keep carbon in the steel ingots from coalescing into graphite, which always robbed the finished product of its strength and surface markings.

The solution? "You heat it up really hot and beat on it really hard," Verhoeven said.

In time, Pendray hit upon a method involving dozens of heating cycles, which would occasionally yield the right external pattern and the microscopic hallmarks of genuine Damascus. But many batches failed, and the men had no idea why.

"We were stumped," Pendray said. "What did we do right? It would make you want to tear your hair out."

Overlooked in their reckoning was an element called vanadium, which made up just .003 percent of some iron the team used.

Verhoeven now believes the steel's markings arise from patchy layers of vanadium that form as the metal cools and hardens. Further heating cycles fill those bands with hard, carbon-rich steel, surrounded by a softer, springier material.

Hard but not brittle

That combination, experts said, gives Damascus steel its lasting sharp edge and makes the metal

hard but not brittle.

Although Verhoeven and Pendray have patented their technique and received some funding from Nucor Steel Inc., they concede the technology in its current, labor-intensive form probably is not a moneymaker.

Their Stanford rivals got closer to finding applications for their version of the metal, including a partnership in the early 1990s with Caterpillar Inc. of Peoria. They still hope that their high-carbon material, which they call "superplastic steel," could allow makers of vehicles such as airplanes to replace riveted sheets with fewer, stronger parts.

The long quest has left Verhoeven and Pendray with a newfound sense of connection to the ancient craftsmen who made the steel for great armies.

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