Northwest
Micro Mineral
Study Group

MICRO PROBE

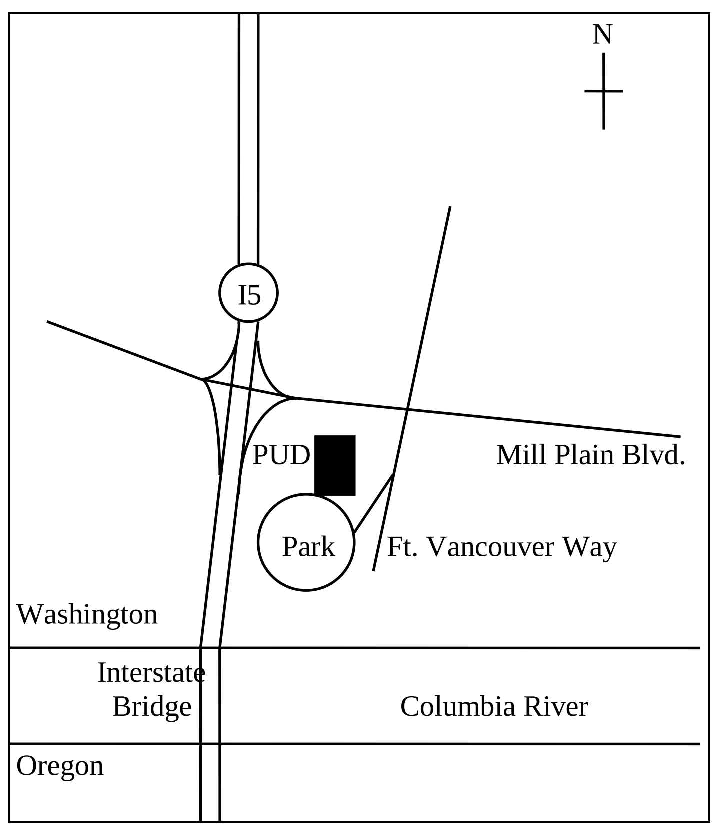
SPRING, 2007 **VOLUME X, Number 5**

SPRING MEETING . . . . .VANCOUVER, WASHINGTON

May 5, 2007 9:00 am to 5:00 pm

Clark County P. U. D. Building
1200 Fort Vancouver Way
Vancouver, Washington

Come celebrate spring talking about your favorite minerals. Bring your microscopes and something for the free table to share with others. As explained on page 16, we will have a lot of material that Paul Lawson collected available as well to look through. We will have our usual brief business meeting in the afternoon, to be followed by our update session to find out what localities are actively producing material and are good bets for collecting trips. No guest speaker has been planned, but Don Howard and Rudy Tschernich will have an interesting update on what has been learned about the agate from Trent, Oregon. If you have slides of mineral specimens or collecting localities that you would like to share, bring them along; we will have a projector and screen waiting. There should be ample time to enjoy looking at each other's special pieces, and swapping stories and information about collecting.



The kitchen area is again available and we will plan on sharing lunch together.

In the evening, many of us plan to go to a local buffet restaurant, so please join us if you can.

Faden Quartz

Matthew Singleton

Reprinted from:
Micro-Scope Newsletter for the micro-mineral collectors of New Zealand
Number 59 (September, 2006).

What is faden quartz? – How is it formed? – What does it look like?
Faden quartz crystals have remained largely unknown, and very little information about them is available. The third volume of Dana's *System of Mineralogy* does not even mention them. *The Mineralogical Record*, Vol. 21, No. 3, May-June 1990, has come to the rescue with a very detailed article on "The Origin of Faden Quartz", by R. Peter Richards. The following descriptions have been taken from that article.

Introduction

The defining characteristic of faden quartz crystals is the presence of a white thread-like or string-like zone, which passes through their interior, usually near their centre. The term is from the German *Faden* (plural *Faden*, pronounced "fah-den"), which means "thread". Faden quartz crystals are usually tabular due to uneven development of the prism faces. The faden not only give these crystals their name, but play a central role in their formation.

Faden quartz crystals are typically found in low grade metamorphic rocks produced by mountain building. The crucial characteristic of the environment of growth is a tectonic setting in which fissures are created and gradually widened. Faden quartz is generally associated with the alpine mineral assemblage, which typically includes albite, adularia, calcite, chlorite minerals and anatase. This assemblage is characteristic of low temperature metamorphic environments. Faden quartz is apparently not found in settings in which more typical quartz may be common, such as pegmatite veins or cavities in sedimentary rock. They have generally been regarded merely as interestingly distorted quartz crystals, and the presence and significance of the faden have been overlooked.

Origin of faden structure

During episodes of mountain building in which the dominant tectonic forces are those of lateral compression (for example, as two tectonic plates collide), the rocks are folded and metamorphosed. Rocks which are more readily deformed "flow" away from the direction of maximum compression, by a combination of processes which include crystallization and grain deformation. Fissures gradually open in directions perpendicular to the maximum tectonic stress. They enlarge and become filled with minerals like calcite and quartz (as the fissure opens or later). In some cases, this process leads to simple veins filled with massive calcite or quartz. Given the right balance between the rates of fissure widening and of mineral growth, however, the minerals can develop as parallel fibres oriented perpendicular or oblique to the vein walls. Several genetic types of fibrous vein fillings can be identified. The type known as "stretched crystal fibres" appears to best explain the development of faden. According to the stretched crystal fibre hypothesis, when the rock first fractures, crystal grains are broken, and new material may be deposited to fill up the opening. The existing grains control the orientation of new mineral growth, which is deposited in crystallographic continuity with the broken edges. This process of cracking and healing of the individual grains is repeated many times. If the rate of deposition of new material is not exceeded by the rate of fissure widening, the eventual result is a series of fibrous crystals that connect the ends of the original grains and span the opening. The boundaries of these fibres are all parallel to each other, but the crystallographic orientations of the fibres are random.

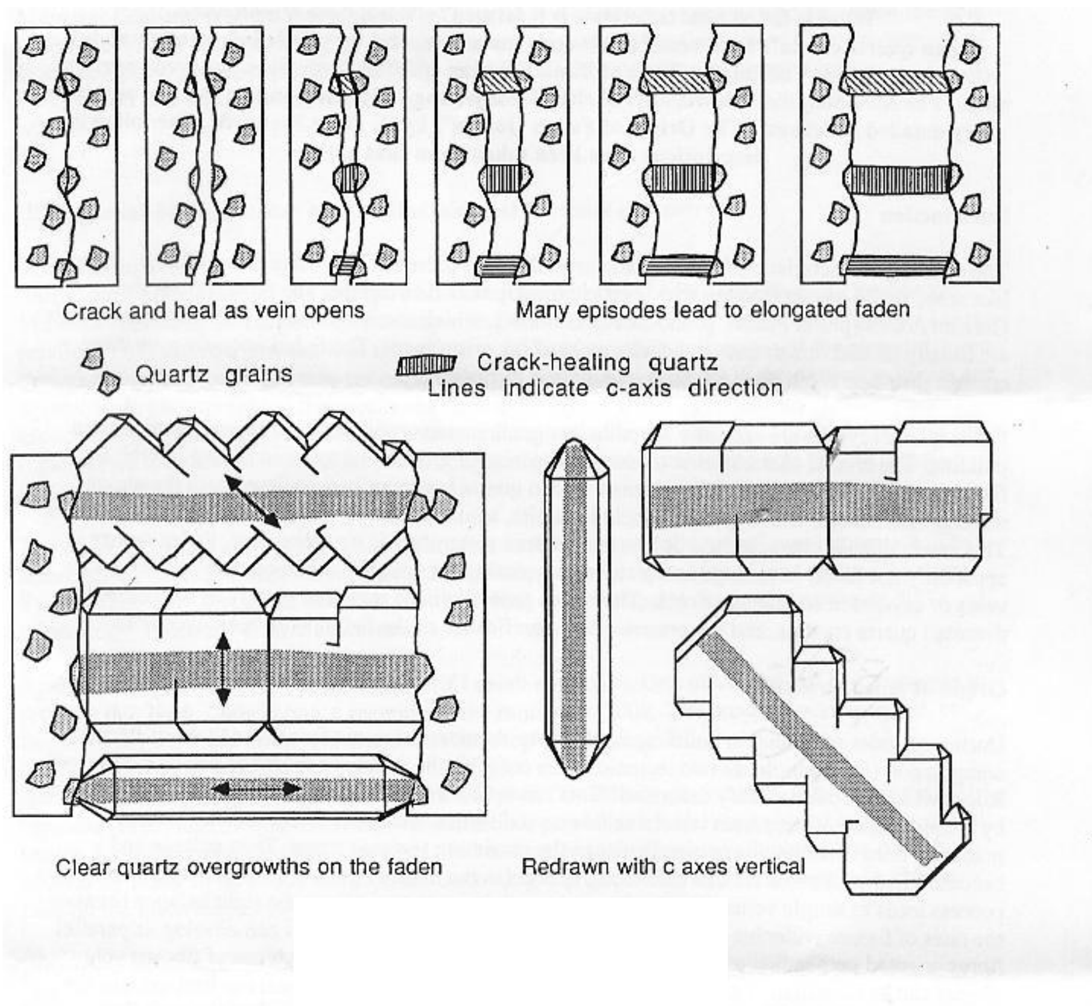
Development of the faden crystal

The second and final development of the faden crystal apparently takes place during the subsequent, tectonically less active period when further growth of the crystal can occur without the frequent fracturing which developed the faden. In what is probably a slower process, more growth occurs on the exposed surfaces of the faden, or crystal fibre. Because the faden is a single crystal fibre, the overgrowth is also a single crystal. However, because the nucleus is a linear feature, the resulting crystal is distorted, "stretched out" in a direction parallel to the faden. During this relatively peaceful period of growth, most of the crystal's volume is deposited.

The faden remains visible as a white "thread" in the middle of the crystal because the fractures do not fully heal as the faden develops. Deposition of new material on a crystal takes place most readily at the edges of the crack, and generally seals the crack before the core of the crystal heals completely with new quartz. As a result, the portion of the crack which transects the crystal core usually remains as a thin zone of fluid-filled inclusions, which typically contain both liquid and gas. The visibility of the faden is due to this parallel series of fluid-filled inclusions.

Faden quartz crystals which have formed according to this basic model have several characteristics: they should contain just one faden each, they should span the fissure in which they occur, and, while then faden should be parallel to each other, the crystals which contain them may have different degrees of distortion and point in different directions. If the crystals become detached from the fissure walls after growth, there will be a scar at each end of the faden, where the crystals were attached to the faces of the fissure.

The simple model is represented in the figure below. Much more detail on formation and variation of faden quartz can be found in *The Mineralogical Record*, Vol. 21, No. 3, May-June 1990, pages 191-201.



Some Zeolite Occurrences in Montana
Part I Western Montana

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The plentiful zeolite collecting locations that occur in Oregon, Washington, and to a less degree in Idaho do not extend into the "Treasure State". Rudy Tchernich (1992) provided a list of Montana locations in "Zeolites of the World". The author has taken his list and expanded upon it through added information in the literature or from field collecting experience. The information is presented in an abbreviated form and interested parties are referred to the references cited. In many of the locations good collecting material is not present, and in some places the zeolites were only recovered in petrographic specimens.

Analcime
Beaverhead County: Igneous rocks, volcanic tuff of the Grasshopper Creek area - found in a single specimen (Pearson, 1989).

Jefferson County: southeast of Helena - Benson Ranch - occurs in large xenolith in the Boulder Batholith (Knopf, 1957)**.**

Brewsterite
Ravalli County: Sheep Creek area, Tirebiter claim (Chris van Lear personal communication, 2005).

Chabazite
Beaverhead County: Igneous rocks, Divide-Dewey area - in pegmatite - questionable identification (Robertson and others, 1953).

Jefferson County: Igneous rocks, north Doherty mafic sill - questionable identification from alteration zone (Hamilton, 1974), Elkhorn Mountains - northern portion - some potassium- rich (Smedes, 1966) - on joint surfaces in volcanics (Smedes, 1966), Boulder Batholith - from pegmatites (Chris van Laer written communication, 2005).

Madison County: Pony district, Billie Sol #1 prospect - small crystals in cavities (Stevenson, 1965); Igneous rocks, Gravelly Range - Black Butte volcanic neck (Burke-Griffin, 1978).

Silver Bow County: Butte district (Jenkins & Lorengo, 2002) - main stage hydrothermal veins (Guilbert & Zeihen, 1964).

Clinoptilolite
Beaverhead County: Volcanic tuff and sediments, Creek, Muddy Creek Basin (Berg, 1994; Berg & Cox, 2001), Dyce Creek, Badger Pass, Medicine Lodge West Fork of Blacktail Creek, and Hepburn's Mesa (Berg & Cox, 2001), several exposures along Grasshopper Creek (Pearson, 1989; Berg & Cox, 2001), north of Bannack (Reynold, 1962).

Deer Lodge County: Sedimenary rocks, Lost Creek area - in ash flow tuff (Berg & Cox, 2001), Anaconda area - clay beds in volcanic breccia (Berg & Cox, 2001).

Powell County: Blossburg clay pit (Bierwagen, 1963).

Ravalli County: West slope of Tabor Mountain - in volcanoclastic beds (Berg & Cox, 2001); Salt Creek - in bedded tuff (Berg & Cox, 2001).

Silver Bow County: Sedimentary rocks, Ramsay - ten miles southwest of Butte - in Tertiary sediments (Berg & Cox, 2001).

Heulandite
Beaverhead County: Igneous rocks, Lost Creek district - rare cavity filling (Collins, 1975); nine miles south of Dillon - [“...sharp amber crystals to two or three millimeters...”] (Rose, 1972), Divide-Dewey area - in pegmatite (Robertson and others, 1953).

Deer Lodge County: Igneous rocks, south of Anaconda - crystals on fracture surfaces and as an alteration product (Iagmin, 1972).

Jefferson County: near Hubbard - crystals (Montana Tech Mineral Museum #5417).

Madison County: Pony district, Billie Sol #1 prospect - small groups of glassy crystals (Stevenson, 1965); Sedimentary rocks, Gravelly Range- Frontier Formations - minute crystals common in sandstone units (Hadley, 1980).

Silver Bow County: Butte district (Jenkins & Lorengo, 2002) - main stage hydrothermal veins (Guilbert & Zeihen, 1964).

Laumontite
Jefferson County: Igneous rocks, Boulder Batholith - uncommon in pegmatite (van Laer, 1985) - Gem Queen pegmatite (Toland, 1973; van Laer, 1985).

Mordenite
Beaverhead County: nine miles south of Dillon - [“...cottony crystal masses...”] (Rose, 1972), Badger Pass and several locations in the Grasshopper Creek area (Pearson, 1989; Berg & Cox, 2001).

Deer Lodge County: Volcanic rocks, Lost Creek area - in ash flow tuff (Berg & Cox, 2001).

Natrolite
Granite County: Igneous rocks, Ravenna area - trace amount (Reitz, 1980).

Lincoln County: Igneous rocks, Rainy Creek complex (Larsen & Pardee, 1929; Heinrich, 1948, 1949).

Scolecite
Madison County: Pony district, Billie Sol #1 prospect - white fibrous rim around chabazite (Stevenson, 1965).

Stilbite
Beaverhead County: Igneous rocks, Utopia (Birch Creek) district - questionable identification (Kennedy, 1979), Divide-Dewey area - in pegmatite (Robertson and others, 1953).

Jefferson County: Boulder Hot Springs area (Weed, 1900; Pardee & Schrader, 1933); Bald Mountain area - in contact metamorphic zone - tentative identification (Ream, 2004); Igneous rocks, Boulder Batholith - uncommon in pegmatite (van Laer, 1985), north of Milligan Canyon - fracture filling (Robinson, 1963), Boulder Hot Springs area

(Dodd, 1981), two miles northwest of Pipestone - in skarn (Toland, 1973; Dick Berg personal communication, 2005).

Madison County: Pony district, Billie Sol #1 prospect - rare (Stevenson, 1965).

Silver Bow County: Butte district (Jenkins & Lorengo, 2002) - main stage hydrothermal veins (Guilbert & Zeihen, 1964); south of Butte along Roosevelt Drive - tiny crystals (Chris van Laer written communication, 2005), Butte area, weathering product of quartz monzonite (Hood, 1963), German Gulch district, Mooney mine (Moen, 1954; Derkery & Derkey, 1987).

Stilbite-Ca
Jefferson County: Bald Mountain area - Yellowstone mine - micro crystals in contact metamorphic zone (French, 2005).

Thomsonite
Madison County: Pony district, Billie Sol #1 prospect - anhedral groundmass (Stevenson, 1965).

Unknown Zeolites
Beaverhead County: Argenta district (Hobbs, 1967); Lost Creek district, Lentung tungsten deposit - contact metamorphic zone (DeBoer, 1991); Utopia (Birch Creek) district - an unknown calcium-bearing mineral of zeolite group - questionable identification (Kennedy, 1979); Igneous rocks, Ruby Range - Camp Creek corundum deposit - in diabase (Heinrich, 1950, 1960), southern Pioneer Range - amygdule filling (Snee, 1978).

Deer Lodge County: Igneous rocks, south of Anaconda - alteration product (Iagmin, 1972).

Flathead County: Hog Heaven district (Jepson, 1993) - questionable amygdule filling (Page, 1963).

Granite County: Igneous rocks, Lower Willow Creek - undetermined zeolites are present in the andesite (Emmons & Calkins, 1913), Foster Creek area (Emmons & Calkins, 1913), Mt. Baldy - Union Peak area (Carter, 1982).

Jefferson County: Igneous rocks, west of Three Forks - in volcanic glass - questionable identification (Robinson & Marvin, 1967), northwest of Three Forks - questionable identification (Robinson, 1963).

Lincoln County: Igneous rocks, Rainy Creek complex (Larsen & Pardee, 1929; Heinrich, 1948)
["...minute radial aggregate..."] (Boettcher, 1966) - questionable identification (Peck, 1960).

Madison County: Silver Star district, Antler mine - questionable identification (Berg, 1986); Summit Valley south of Cardwell (Hess, 1976); Igneous rocks, in cavities along Ennis-Virginia City Highway east of Virginia City (Feldman, 1985), Sappington pegmatite - questionable identification (Jovisk, 1942), southern Tobacco Root Mountains (Hess, 1967) - in small vesicles in basalt (Cordua, 1973).

Missoula County: Igneous rocks, Garnet-Coloma area (Wilkie, 1986).

Powell County: Emery district, Carbonate Hill area (Billingsley & Grimes, 1918); Igneous rocks, Baggs Creek area - rare (Billingsley & Grimes, 1918).

Silver Bow County: Butte district - Continental orebody (Ratcliff, 1973); Igneous rocks, near Butte - sporadic in the Lowland Creek Volcanics (Smedes, 1962).

References

Berg, R. B., 1986, Clinochlore from the Silver Star district, Madison County, Montana: Clays and Clay Minerals, v. 34, n. 4, p. 496-498.

Berg, R. B., 1994, Zeolitic alteration of tuffaceous sedimentary rocks of Tertiary age, southwestern Montana: (abs) Geological Society of America, Programs with Abstracts, v. 26, n. 6, p. 4.

Berg, R. B., and Cox, B. E., 2001, Zeolite occurrences in Western Montana with particular emphasis on the Grasshopper Creek deposit: Montana Bureau of Mines and Geology Bulletin 132, 46 p.

Bierwagen, E. E., 1964, Geology of the Black Mountain area, Lewis and Clark and Powell Counties, Montana: Princeton, New Jersey, Princeton University, Ph. D. Dissertation, 160 p.

Billingsley, P., and Grimes, E. M., 1918, Ore deposits of the Boulder Batholith of Montana: American Institute of Mining Engineering Transactions, v. 58, p. 284-335.

Boettcher, A. L., 1966, The Rainy Creek igneous complex near Libby, Montana: University Park, Pennsylvania State University, Ph. D. Dissertation, 155 p.

Burke-Griffin, B. M., 1978, Geology, petrology, and geochemistry of the Black Butte volcanic neck, Gravelly Range, Montana: Parkside, University of Wisconsin, M. S. Theis, 102 p.

Carter, B. A., 1982, Geology of the Eocene volcanic sequence, Mt. Baldy-Union Peak area, central Garnet Range, Montana: Missoula, University of Montana, M. S. Thesis, 55 p.

Collins, B. I., 1975, A petrochemical model for the tungsten-bearing skarns in the Pioneer Mountains, Montana: Missoula, University of Montana, Ph. D. Dissertation, 140 p.

Cordua, W. S., 1973, Precambrian geology of the southern Tobacco Root Mountains, Madison County, Montana, Bloomington, Indiana University, Ph. D. Dissertation, 247 p.

DeBoer, T. A., 1991, Geology and mineralization of the Lentung tungsten skarn deposit near Brownes Lake, Pioneer Mountains, Montana: Bellingham, Western Washington University, M. S. Thesis, 216 p.

Derkey, R. E., and Derkey, P. D., 1987, Mont Mods: Mine and mineral occurrence database for Silver Bow County (exclusive of the Butte district): Montana Bureau of Mines and Geology Open-File Report 185, 197 p.

Dodd, S. P., 1981, The mineralogy, petrology and geochemistry of the uranium-bearing vein deposits near Boulder, Montana and their relationship to faulting and hot spring activity: Bellingham, Western Washington University, M. S. Thesis, 71 p.

Emmons, W. H., and Calkins, F. C., 1913, Geology and ore deposits of the Philipsburg quadrangle, Montana: U. S. Geological Survey Professional Paper 78, 271 p.

Feldman, R., 1985, The Rockhound's Guide to Montana: Falcon Press, Billings, Montana, 156 p.

French, L. B., 2005, Stilbite-Ca and associated minerals from the Bald Mountain skarn, Jefferson County, Montana: Micro Probe, v. 10, n. 2, p. 2-3.

Guilbert, J. M., and Zeihen, L. G., 1965, Mineralogy of the Butte district, Montana: (abs) American Mineralogist, v. 50, p. 286.

Hadley, J. B., 1980, Geology of the Varney and Cameron quadrangles, Madison County, Montana: U. S. Geological Survey Bulletin 1459, 108 p.

Hamilton, T. S., 1974, The petrology of the north Doherty mafic sill, Jefferson County, Montana: Bloomington, Indiana University, M. S. Thesis, 117 p.

Heinrich, E. Wm., 1948, Pegmatite mineral deposits of Montana: Montana Bureau of Mines and Geology Memoir 28, 56 p.

Heinrich, E. Wm., 1949, Pegmatites of Montana: Economic Geology, v. 44, p. 307-335.

Heinrich, E. Wm., 1950, The Camp Creek corundum deposit near Dillon, Beaverhead County, Montana: Montana Bureau of Mines and Geology Miscellaneous Contribution 11, 20 p.

Heinrich, E. Wm., 1960, Pre-beltian geology of the Cherry Creek and Ruby Mountains areas, southwestern Montana; Part 2 Geology of the Ruby Mountains: Montana Bureau of Mines and Geology Memoir 38, p. 15-40.

Hess, D. F., 1967, Geology of the Pre-Beltian rocks in the central and southern Tobacco Root Mountains with reference to supposed effects of the Laramide-age Tobacco Root Batholith: Bloomington, Indiana University, Ph. D. Dissertation, 333 p.

Hess, D. F., 1976, Agate locality, Summit Valley, Montana: Earth Science, v. 29, n. 6, p. 291.

Hobbs, B. B., 1967, Structure and stratigraphy of the Argenta area, Beaverhead County, Montana: Corvallis, Oregon State University, M. S. Thesis, 164 p.

Hood, W. C., 1963, Weathering of Butte quartz monzonite near Butte, Montana: Missoula, University of Montana, Ph. D. Dissertation, 87 p.

Iagmin, P. J., 1972, Tertiary volcanic rocks south of Anaconda, Montana: Missoula, University of Montana: M. S. Thesis, 53 p.

Jenkins, R. E., and Lorengo, J. A., 2002, Butte, Montana: minerals, mines and history: Mineralogical Record, v. 33, n. 1, p. 5-69.

Jepson, W. E., 1993, Lateral and vertical zonation of clay minerals and associated alteration products at the Hog Heaven mine and Ole Hill deposit, Hog Heaven mining district, Flathead County, Montana: Missoula, University of Montana, M. S. Thesis, 103 p.

Jovick, J. N., 1942, Mineral occurrences in certain pegmatite dikes in southwestern Montana: Butte, Montana School of Mineral Science and Technology, B. S. Thesis, 21 p.

Kennedy, D. B., 1979, Geology and economic evaluation of part of the Utopia mining district, Beaverhead County, Montana: Cheney, Eastern Washington University, M. S. Thesis, 142 p.

Knopf, A., 1957, The Boulder batholith of Montana: American Journal of Science, v. 255, p. 81-103.

Larsen, E. S. and Pardee, J. T., 1929, The stock of alkaline rocks near Libby, Montana: Journal of Geology, v. 37, p. 69-112.

Moen, W. S., 1954, Uranium mineralization at the Mooney claim, Silver Bow County, Montana: U. S. Atomic Energy Commission Report RME-2006, 15 p.

Page, W. D., 1963, Reconnaissance geology of the north quarter of the Horse Plains quadrangle, Montana: Boulder, University of Colorado, M. S. Thesis, 65 p.

Pardee, J. T., and Schrader, F. C., 1933, Metalliferous deposits of the greater Helena mining region, Montana: U. S. Geological Survey Bulletin 842, 309 p.

Pearson, R. C., 1989, Zeolite-bearing Cretaceous tuff in Beaverhead County, southwest Montana: U. S. Geological Survey Open File Report 89-0297, 10 p.

Peck, J. H., 1960, An evaluation of the mineral deposits of the Rainy Creek district near Libby, Montana: Amherst, University of Massachusetts, B. S. Thesis, 51 p.

Ratcliff, M. W., 1973, Copper and molybdenum mineralization in the Continental deposit, East Butte district, Montana: *in* Society of Economic Geologists Butte Field Meeting Guidebook, Anaconda Company, p. I1-I8.

Ream, L. R., 2004, The skarns of Montana: Pacific Northwest Chapter Friends of Mineralogy, June 2004, Bulletin p. 4-5 & 8.

Robinson, G. D., 1963, Geology of the Three Forks quadrangle, Montana: U. S. Geological Survey Professional Paper 370, 143 p.

Reitz, B. R., 1980, Evolution of tertiary plutonic and volcanic rocks near Ravenna, Granite County, Montana: Manhattan, Kansas State University, M. S. Thesis, 90 p.

Reynold, S. T., 1962, Geology of the northern half of the Bannack quadrangle Beaverhead County, Montana: Berkeley, University of California, M. S. Thesis, 54 p.

Robinson, G. D., 1963, Geology of the Three Forks quadrangle, Montana: U. S. Geological Survey Professional Paper 370, 143 p.

Robinson, G. D., and Marvin, R. F., 1967, Upper Cretaceous volcanic glass from western Montana: Geological Society of America Bulletin, v. 78, n. 5, p. 601-608.

Robertson, F., Young, F. M., and Williams, H., 1953, Zeolites in pegmatites at Divide-Dewey contact of the Boulder Batholith: (abs) Geological Society of America Programs with Abstracts, v. 64, pt. 2, p. 1553-1554.

Rose, S. W., 1972, Locality for mordenite and other minerals in S. W. Montana: Rocks and Minerals, v. 47, n. 4, p. 247.

Smedes, H. W., 1962, Lowland Creek volcanics, an Upper Oligocene formation near Butte, Montana: Journal of Geology, v. 70, n. 3, p. 255-266.

Smedes, H. W., 1966, Geology and igneous petrolgy of the northern Elkhorn Mountains Jefferson and Broadwater Counties, Montana: U. S. Geological Survey Professional Paper 510, 116 p.
Snee, L. W., 1978, Petrology, K-AR ages, and field relations of the igneous rocks of part of the Pioneer batholith, southwestern Montana: Columbus, Ohio State University, M. S. Thesis, 110 p.

Stevenson, R. G., 1965, Mineralogy, petrology, and geochemistry of a complex mineral association near Pony, southwest Montana: Bloomington, Indiana University, Ph. D. Dissertation, 130 p.

Toland, D. C., 1973, Crystal collecting in southwestern Montana: Bozeman, Montana State University, M. S. Thesis, 109 p.

Tschernich, R. W., 1992, Zeolites of the World: Geoscience Press Inc., Phoenix, AZ, 563 p.

van Lear, W. C., 1985, Boulder Batholith pegmatites: Lapidary Journal, v. 39, n. 2, p. 242-247.

Weed, W. H., 1900, Mineral vein formation at Boulder Hot Springs, Montana: U. S. Geological Survey 21st Annual Report 1899-1900, Part 2, p. 227-255.

Wilkie, K. M., 1986, The geology of the Garnet-Coloma area, Garnet Range, Montana: Ames, Iowa State University, M. S. Thesis, 169 p.

Update on Zeolite Species

Donald G. Howard

The contribution to our continuing update of data sheets for zeolites brings us to five recent and very rare new species. Only one of these – bellbergite – is abundant enough that the collector is likely to run across it. Three others all came out of a single rock sample collected by a research team in Antarctica. They are interesting because the same rock contained boggsite and tschernichite as well, and the new minerals are closely related in structure to boggsite. All four of these minerals would have fallen into the zeolite classification by the old rules as well as by the new ones. They are all hydrated aluminum silicates, with the water and cations loosely held.

The fifth addition should probably have been included in the set featured in the last issue. It has a framework of silica tetrahedral, but is held together by tetrahedral centered on beryllium instead of aluminum. By the new rules, that still qualifies as a zeolite since it has a framework with channels and replaceable cations.

These five species are here included for completeness. Hopefully, they may be found in some more accessible places in the future, so that they could be added to our collections. I hope you enjoy reading about them anyway.

THE MICROPROBE

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Bellbergite

$(K,Ba,Sr)_2\ Sr_2\ Ca_2\ (Ca,Na)_4\ Al_{18}\ Si_{18}\ O_{72} \cdot 30\ H_2O$, Z = 1

Named in 1992 for the locality at which it was found.

Type locality: The Bellberg volcano, in the Laacher See volcanic area, Eifel, Germany.

Structure

Crystal System: Hexagonal
Space Group: $P6_3/mmc$, $P6_3mc$, or P62c
Crystal axes: a=13.244 A
c=15.988 A
Type of Structure: 6-fold rings of tetrahedral which form layers perpendicular to the c-axis. The stacking order of layers appears to be ABBACC, but there seems to be considerable disorder. The framework corresponds to structure type EAB.

Physical Properties

Color: colorless to white
Streak:
Luster: vitreous
Hardness: **5**
Density: 2.20 g/cm^3
Fracture: conchoidal
Cleavage: none
Twinning:

Optical Properties

Refractive Index:
ω = 1.522
ε = 1.507
(λ = 589nm)
uniaxial negative

Morphology

Hexagonal dipyramids up to about 0.3 mm in length, or subparallel intergrown and elongated along [00.1] with transparent colorless tops and rough white lateral faces.
Forms: {1012}.

Chemical Composition

$Ba_{0.26}\ Na_{0.72}\ K_{1.33}\ Sr_{2.36}\ Ca_{5.32}\ Al_{17.55}\ Si_{18.36}\ O_{72} \cdot 30\ H_2O$

Occurrence

The mineral occurs in thin marginal contact zones where hybrid rocks have been produced from xenolithic material and lava. Cavities in the hybrid zone are lined with crystals of sanidine and clinopyroxene and contain reddish brown aggregates of altered pyrrhotine, bellbergite, spheres of thomsonite, and tufts of ettringite needles..

Germany

Found in Ca-rich xenoliths at the Bellberg volcano near Mayen, Eifel

References:

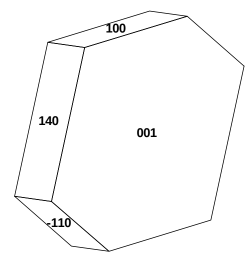
1. Rudinger, B., Tillmanns, E., & Hentschel, G., *Bellbergite – a New Mineral with the Zeolite Structure Type EAB,* **Mineralogy and Petrology 48**, pg 147-152 (1993).

Gottardiite

$(Na_{2.5} K_{0.2} Mg_{3.1} Ca_{4.8}) (Al_{18.8} Si_{117.2}) O_{272} \cdot 93 H_2O$

Named in 1996 for Glauco Gottardi, pioneer researcher of natural zeolite structure.

Type locality: Mt. Adamson, Northern Victoria Land, Antarctica



Structure

Crystal System: Orthorhombic (pseudo-hexagonal)
Space Group: Cmca
Crystal axes: a=13.698 A
b=25.213 A
c=22.660A

Type of Structure: Impermeable sheets are formed parallel to (001). This results in a two-dimensional system channels parallel to the ab plane. Straight 10-membered-ring channels run parallel to [100], and through 10-ring windows link 12-ring channels that are interrupted by 4-rings of tetrahedral that join the sheets, so they are not straight but 'snake' through parallel to [010]. The topology is the same as that of the synthetic zeolite NU-87.

Physical Properties

Color: transparent, colorless to light straw
Streak:
Luster:
Hardness:
Density: 2.14 g/cm^3
Fracture: brittle, conchoidal to irregular
Cleavage: {001} perfect
Twinning: none observed.

Optical Properties

Refractive Index:
α = 1.480
β = 1.485
γ = 1.486
X=b, Y=a, Z=c
biaxial negative
2V < 60^o

Morphology

Thin lamellae, flattened on (001), pseudo-hexagonal or elongated along [100], in wedge-shaped aggregates of a few individuals. Maximum crystal size is 0.3x0.2x0.02mm.
Forms: Dominant form {001}, {100}, {140} and {-110} minor.

Chemical Composition

$(Na_{2.5} K_{0.2} Mg_{3.1} Ca_{4.8}) (Al_{18.8} Si_{117.2}) O_{272} \cdot 93 H_2O$

Occurrence

Cavities in a single dolorite sample from basaltic andesites that overlay a layer of sediments.

Antarctica

Found at Mt. Adamson, Northern Victoria Land, in cavities and small fractures in a single rock. Other minerals occurring in the same rock are mordenite, heulandite, erionite, phillipsite, stilbite, levyne, epistilbite, tschernichite, boggsite, cowlesite, terranovaite, mutinaite, quartz, cristobalite, apophyllite, gypsum and calcite..

References:

2. Alberti, A., Vezzalini, G., Galli, E., & Quartieri, S., *The crystal structure of gottardiite, a new natural zeolite,* **Eur. J. Mineral. 8**, pg 69-75 (1996).
3. Galli, E., Quartieri, S., Vezzalini, G., & Alberti, A., *Gottardiite, a new high-silica zeolite from Antarctica: the natural counterpart of synthetic NU-87,* **Eur. J. Mineral. 8**, pg 687-693 (1996).

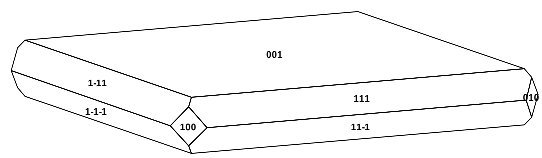
Nabesite

$Na_2 Be Si_4 O_{10} \cdot 4 H_2O$; Z = 4

Named in 2002 after the chemical composition.

Type locality: The Kvanefjeld Plateau, in the northwesternmost part of the Ilimaussaq alkaline complex, South Greenland.

Structure



Crystal System: Orthorhombic
Space Group: $P2_12_12_1$
Crystal axes: a=9.748 A
b=10.133
c=11.954 A
Type of Structure: SiO_4 tetrahedral share corners to form 4- and 8-membered rings in sheets parallel to (001). The sheets are linked by BeO_4 groups. Intersecting channels run along [110] and [-110], in which the water and sodium ions are located.

Physical Properties

Color: colorless, transparent
Streak: white
Luster: vitreous
Hardness: 5-6
Density: 2.16 g/cm^3
Fracture: uneven, brittle
Cleavage: good on {110} and {001}
Twinning:

Optical Properties

Refractive Index:
α = 1.499
β = 1.507
γ = 1.511
X=a, Y=c, Z=b
biaxial negative
2V = 65^o

Morphology

Aggregates of thin, platy crystals in subparallel to parallel orientation, up to 5x10x10mm. Individual crystals range in size from 0.05x0.5x0.5 to 0.2x5x5mm, flattened on {001} with beveled edges {111}.
Forms: {001} dominant, {111} and {1-11} about equally developed. {010} and {100} are minor.

Chemical Composition

$(Na_{1.74} K_{0.03} Ca_{0.01}) Be_{0.98} Si_{4.06} O_{10} \cdot 3.92 H_2O$
The mineral shows considerable progressive alteration to an opal-like silica mineral.

Occurrence

The mineral occurs in cavities in a tugtupite-bearing albitite cutting augite syenite.

Greenland

Found in cavities in albitite on the Kvanefjeld Plateau, in the northwesternmost part of the Ilimaussaq alkaline complex. Associated minerals are albite, gmelinite, neptunite, analcime, gonnardite, and lovdarite. Also known to occur in the albitites are aegitine, beryllite, bertrandite, chkalovite, epistolite, galena, mangoan pectolite (“schizolite”), microcline, Na-komarovite, pyrochlore, sphalerite and togtopite.

References:
4. Petersen, O., Giester, G., Brandstatter, F., & Niedermayr, G., *Nabesite, , a new mineralspecies from the Ilimaussaq Alkaline Complex, South Greenland*, **Can. Min. 40**, pg 173-181 (2002).

Mutinaite

$(Na_{2.76}\ K_{0.11}\ Mg_{0.21}\ Ca_{3.78})\ (Al_{11.20}\ Si_{84.91})\ O_{192} \cdot 60\ H_2O$

Named in 1997 for the city of Modena, Italy, where the researchers responsible for describing the mineral are centered.

Type locality: Mt. Adamson, Northern Victoria Land, Antarctica

Structure

Crystal System: Orthorhombic
Space Group: Pnma
Crystal axes: a=20.233 A
b=20.052 A
c=13.491A
Type of Structure: Two sets of channels of 10-membered rings exist. The channels along [010] are straight while those along [001] are sinusoidal. The Si and Al appear to be completely disordered. The mineral is the natural analog of the synthetic zeolite ZSM-5.

Physical Properties

Color: colorless to milky white
Streak: white
Luster: vitreous to silky-lusterous
Hardness:
Density: 2.14 g/cm^3
Fracture: brittle, irregular
Cleavage: {100} good
Twinning: none observed.

Optical Properties

Refractive Index:
$\alpha = 1.485$
$\beta = 1.487$
$\gamma = 1.488$
X=b, Y=a, Z=c
biaxial negative
2V = 110^o

Morphology

Subparallel aggregates of radiating, lathlike fibers up to 1.8mm in diameter. Also as aggregates of tiny tabular crystals on (100) elongated along either b or c, with maximum dimension of 200μm.
Forms: Dominant form {100}, {110} and {010} intermediate, {032} minor.

Chemical Composition

$(Na_{2.76}\ K_{0.11}\ Mg_{0.21}\ Ca_{3.78})\ (Al_{11.20}\ Si_{84.91})\ O_{192} \cdot 60\ H_2O$

Occurrence

Cavities in a single dolorite sample from basaltic andesites that overlay a layer of sediments.

Antarctica

Found in a single rock at Mt. Adamson, Northern Victoria Land, in several completely filled cavities associated with heulandite. Also as an aggregate of crystal blades associated with terranovaite and tschernichite. Other zeolites occurring in the same rock are boggsite, mordenite, levyne, erionite and chabazite.

References:

5. Galli, E., Vezzalini, G., Quartieri, S., Alberti, A., & Franszini, M., *Mutinaite, a new zeolite from Antarctica: The natural counterpart of ZSM-5*, **Zeolites 19**, pg 318-322 (1997).
6. Vezzalini, G., Quartieri, S., Galli, G., Alberti, A., Cruciani, G., & Kvick, A., *Crystal structure of the zeolite mutinaite, the natural analog of ZSM-5*, **Zeolites 19**, pg 323-325 (1997).).

Terranovaite

Na Ca Al_3 Si_{17} O_{40} $\cdot$ >7 H_2O ; Z = 4 .

Named in 1997 for the Italian Antarctic Station at Terrenova Bay, Antarctica.

Type locality: Mt. Adamson, Northern Victoria Land, Antarctica

Structure

Crystal System: Orthorhombic
Space Group: Cmcm or C2cm
Crystal axes: a=9.747 A
b=23.880 A
c=20.068A
Type of Structure: Two different chains developing along [100] form wavy impermeable sheets parallel to (010). This results in a two-dimensional system of ten-membered ring channels along [100] and [001].

Physical Properties

Color: transparent, bluish
Streak: white
Luster: vitreous
Hardness:
Density: 2.13 g/cm^3
Fracture: brittle, irregular
Cleavage: {010} perfect, with distinct {001} parting
Twinning: none observed.

Optical Properties

Refractive Index:
α = 1.476
β = 1.478
γ = 1.483
X=c, Y=a, Z=b
biaxial positive
2V = 65^o

Morphology

Globular masses that flake off in transparent lamellae. Also as a transparent, tabular crystal
Forms: Dominant form {010}, {001} and {110} less developed.

Chemical Composition

$(Na_{4.2}\ K_{0.2}\ Mg_{0.2}\ Ca_{3.7})\ (Al_{12.3}\ Si_{67.7})\ O_{160} \cdot > 29\ H_2O$

Occurrence

Cavities in a single dolorite sample from basaltic andesites that overlay a layer of sediments.

Antarctica

Found at Mt. Adamson, Northern Victoria Land, in three cavities in a single rock. In two completely filled cavities, it was associated with heulandite. In a third cavity, a crystal measuring 0.7x0.6x0.2mm was observed resting upon a cluster of mutinaite with tschernichite also present in the cavity. Other minerals occurring in the same rock are boggsite, mordenite, levyne, erionite, chabazite, quartz, cristobalite, apophyllite, gypsum and calcite..

References:
7. Galli, E., Quartieri, S., Vezzalini, G., Alberti, A., & Franszini, M., *Terranovaite from Antarctica: A new 'pentasil' zeolite*, **American Mineralogist 82**, pg 423-429 (1997).

SPECIAL FREE TABLE OFFERING
from Paul Lawson
ZEOLITE AND ASSOCIATED MINERALS

Kalama, Washington
    Stilbite, chabazite, analcime, thomsonite, heulandite, calcite, aragonite
    Quartz and calcite pseudomorphs after aragonite
Goble, Oregon
    Thomsonite, stilbite
Wren, Oregon
    Natrolite, calcite, laumontite
Springfield, Oregon
    Natrolite

Paul Lawson, a former NWMMSG member, from Vancouver, Washington donated his rock and mineral collection to the Rice Museum. The collection was sorted into specimens to be put into the Rice Museum collection, those that will be sold in the gift shop (proceeds going into the mineral acquisitions fund), those that go on the rock pile (primarily for kids), and into a special group containing micro crystals.

The micro crystals will be put on the Free Table at the coming May meeting. Most of the material consists of zeolites and carbonates from the I-5 freeway widening in 1970 but there are some from other localities. Some of the material needs trimming and cleaning. Bring some boxes for material. This will be a one-time offering.

Additional larger specimens will be for sale (proceeds go into the mineral acquisitions fund at the Rice Museum).

Rudy Tschernich
Curator
Rice NW Museum of Rocks and Minerals
Hillsboro, Oregon