NEWSLETTER

of the INDIANA CHAPTER, FRIENDS OF MINERALOGY, INC.

Volume I: No. 5 September 1987

Our Next Chapter Meeting:

Saturday, September 12, 1987
4:00 pm
at the 11th Annual Rock Show & Swap
Hancock County Fairgrounds
Greenfield, Indiana

Program: "Mineral Identification" by Nelson Shaffer

Agenda:
1. Liability insurance
2. Field Trips for the fall
3. Proposals for a State Mineral, a traveling chapter mineral display, and a State Museum loan exhibit
4. Ideas for 1988 projects
5. Amendment to the Articles of Incorporation (See the following article)

Our meetings are open to the public, so feel free to bring your friends and family. We also hope to attract new members from the people attending the show. Come on out for a good program!

IMPORTANT ANNOUNCEMENT!

At the September meeting, our Chapter will have to vote for a change in our Articles of Incorporation to comply with a requirement of the IRS before we can get our federal 501 (c)(3) tax-exempt status. The change will be sent to the State, and the amended Articles sent to the IRS.

The change does not affect our operations or policies; all we are doing is taking our constitution's article on dissolution and making it a part of Article II of the Articles of Incorporation, as well. A copy of the amended article is on the reverse side of this page, for your study. Purposes 1 through 7 are unchanged; number 8 is what we are adding. Thank you!

Purposes of the Indiana Chapter:

1. *To promote interest in and knowledge of mineralogy.*
2. *To advance mineralogical education.*
3. *To protect and preserve mineral specimens and promote conservation of mineral localities.*
4. *To further cooperation between amateur and professional and encourage collection of minerals for educational value.*
5. *To support publications about mineralogy and about the programs of kindred organizations.*

Upcoming Chapter Meetings:

September: September 5, 9:00 am. Field Trip to Anderson, IN.

September: September 12, 4:00 pm, at the Greenfield, Indiana Swap
"Mineral Identification" by Nelson Shaffer

September/October: Field Trip Cave Stone Quarry, near Hope, Indiana.
Date to be determined.

November: Annual Meeting - Sunday, November 8 1:00 pm
at the Indiana State Museum, 202 N. Alabama St., Indianapolis
Agenda: Election of officers for 1988, setting of 1988 dues.
Program: Indiana Minerals

FIELD TRIP!

Our Field Trip Chairman, Vern Swanson, mailed out information to the membership about a new field trip to Irving Materials, Inc. (IMI) Quarry near Anderson, Indiana on September 5, 1987. We will look forward to some good results and, if Vern's streak with good weather holds out, we should have a beautiful day.

"Origin of Geodes"

The attached article on the formation of geodes is from a field trip guide published by the Illinois Geological Survey. Each year the Survey publishes new guides and leads field trips open to the general public. Various aspects of geology are covered in each trip: minerals, landforms, and fossils. We are now on their mailing list for future trips.

Chapter Mineral Display...

Shirley Allen has offered to head a committee to organize a display of Indiana minerals which could be exhibited at various shows. She suggests members could loan good quality specimens for this display. This will be discussed at the September meeting.

Q. "What is Indiana's State Mineral?"

A. " "

The exact text of Article(s) **II (Proposed Amendment)** of the Articles of Incorporation is now as follows.

1. **To promote interest in and knowledge about mineralogy.**
2. **To advance mineralogical education.**
3. **To protect and preserve mineral specimens and promote conservation of mineral localities.**
4. **To further cooperation between amateur and professional and encourage collection of minerals for educational value.**
5. **To support publications about mineralogy and about the programs of kindred organizations.**
6. **This chapter is organized exclusively for educational and scientific purposes. Notwithstanding any other provision of these articles, this organization shall not carry on any other activities not permitted to be carried on by (a) a corporation exempt from Federal income tax under section 501(c)(3) of the Internal Revenue Code of 1954 (or the corresponding provision of any future United States Revenue Law) or (b) by a corporation, contributions to which are deductible under Section 170(c)(2) of the Internal Revenue Code of 1954 (or corresponding provision of any future United States Revenue Law.).**
7. **This organization is not formed for profit. No assets or net earnings of the Chapter shall inure to the benefit of, or be distributable to, its members, officers, or other private person.**
8. **Upon the dissolution of the corporation, assets shall be distributed to the Friends of Mineralogy, Inc. (the national organization). Should that organization no longer exist or retain its 501(c)(3) status at the time of dissolution, then the assets shall be given to another 501(c)(3) organization which is organized and operated exclusively for one or more purpose for which this chapter was organized. Any such assets not so disposed of shall be disposed of by a Court of Competent Jurisdiction, exclusively for such purposes or to such organizations, as the Court shall determine, which are organized and operated for such purposes.**

ORIGIN OF GEODES

Geodes are usually globular although they also may be irregular, discoid, or sometimes shaped very much like fossils. They are usually found in limestone, but they may also form in shaly rocks. Most of them are hollow, but many have become filled with minerals growing from the walls inward.

A typical geode sawed or broken in two will disclose a sequence of layers from the outside-in as follows: (1) a thin clay layer; (2) a layer of noncrystalline chalcedony; (3) crystals (usually quartz) projecting into the hollow interior. Less commonly calcite or dolomite crystals will form next to the outer chalcedony layer instead of quartz, and sometimes the inside of a geode will be nothing but chalcedony; and (4) a deposit of minor minerals, commonly as crystal druses of pyrite, ankerite, magnetite, hematite, kaolin, aragonite, millerite, chalcopyrite, sphalerite, limonite, smithsonite, malachite, gypsum, fluorite, barite, marcasite, geothite, pyrolusite, and possibly tenorite and chalcocite. Perhaps the most thought provoking and rarest of geodes are those which contain petroleum or some thicker bituminous material.

By what processes and under what conditions did these interesting features originate? There are many theories, none of which are completely adequate. The following discussion is an attempt to compile some of them into a brief summary.

First of all, it is generally agreed that geodes are cavity fillings. The agreement ends here, for the stumbling block is the origin of the inital cavity. One idea is that the cavities are "vugs" caused by gas pockets or by shrinkage of the rock. However, vugs are integral parts of the rock in which they are contained, whereas geodes are complete entities which can be broken out of the rock formation with comparative ease. Some geologists have suggested that they are merely special types of concretions, but geodes grow from the outer shell inward, whereas concretions build up from a central core. Bassler (1908, pp. 133-154) has shown that some geodes originate in fossil cavities and upon growth of the geode, the fossil bursts. Upon further growth, the fragments of the fossil are dissolved or absorbed by the growing geode and are lost. Van Tuyl (1916, pp. 34-42) believes that the original cavity is the space which was occupied by a concretion. Concretions are easily removed from the rock by percolating waters and would thus leave a likely cavity in which a geode could grow. The fact that some geodes contain calcareous clay concretions lends support to this theory.

Pettijohn (1957, pp. 204-205) gives a rather complex process by which geodes grow after the formation of an initial cavity. This process may be summarized in the following steps: (1) a cavity is formed in the rock by some means; (2) a salty solution fills the cavity and pore spaces in the rock; (3) a layer of gelatinous silica is then deposited, isolating the salt solution in the cavity; (4) later the water in the surrounding pore spaces becomes fresh. This sets up what is known as an osmotic cell. This particular osmotic cell consists of two different types of solutions separated by a membrane of gelatinous silica which will allow the fresh solution to pass into the geode cavity, but will not allow the salt to pass out of it; (5) the fresh water flowing into the cavity by osmosis builds up internal pressure which pushes on the walls of the geode; (6) this pressure, exerted outward against the surrounding limestone, dissolves the limestone, leaving an insoluble residue which becomes the thin clay layer on the outer surface of the geode; (7) the above process continues until the salt solution is so diluted by the incoming fresh water that the osmotic cell no longer operates. The geode has reached maturity; (8) gradually the silica gel dehydrates and crystallizes; (9) shrinking and cracking then follow; (10) finally, mineral-bearing waters flowing through the cracks deposit the innermost layer of minerals. These cracks may eventually seal, leaving a completely closed geode.

The process by which some of the geodes of the Warsaw beds came to contain petroleum is also very much a mystery. Frank Fleener (1961) gives an interesting account of the problem. He envisions the petroleum having migrated up into the Warsaw Formation from the oil-bearing rocks to the south. There partially formed geodes were found with loose quartz crystals (some doubly terminated) adrift in the thick bitumen. The influx of the bituminous material stopped the growth of the geodes, but the mechanism by which the bitumen was enclosed and hermetically sealed remains a matter of conjecture. We believe that many of these geodes are hermetically sealed because the bituminous material will sometimes squirt out with force when the geode is punctured. This phenomenon is presumably due to the sudden expansion of the material when the pressure under which it was formed is relieved.

A more plausible explanation for the petroleum is that it was derived from the enclosing shale and shaly limestone. The weight of overlying sedimentary rocks could easily have freed hydrocarbons from the organic matter in the shale and shaly limestone. The hydrocarbons then migrated to zones of lowest pressure, and these most likely would be the cavities inside the geodes. It appears that such a pressure difference would exist because the hard shell of the geode could withstand a great amount of lithostatic pressure.

The above discussion of the origin of geodes is incomplete and generalized, but we hope that it will stimulate interest in these remarkable features. Perhaps as you break them open in search of beautiful crystals, you will reflect upon their history and feel a greater appreciation for the intricate processes by which nature is continuously altering the crust of the earth.

REFERENCES

Bassler, R. S., The Formation of Geodes, with Remarks on the Silicification of Fossils: National Museum Proc., vol. 35, 1908, pp. 133-154.

Fleener, Frank L., Our Fascinating and Enigmatic Geodes: Earth Science, vol. 14, no. 1, Feb. 1961, pp. 24-27.

Pettijohn, F. J., Sedimentary Rocks, Harper and Brothers, New York, 1957, pp. 204-205.

Van Tuyl, F. M., The Geodes of the Keokuk Beds: American Journal of Science, Series 4, vol. 42, 1916, pp. 34-42.