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The Use of Calcite in Earth Science

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INTRODUCTION

The many physical and chemical properties of minerals often are difficult for students to grasp. One of the reasons is that the student is not only confronted with the task of learning the meaning of a multitude of descrptive terms applied to minerals but is also placed in the position of trying to use these terms for many different minerals whose properties are considerably different.

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Schirner

It is felt that this is not only an impossible task but a foolish one as well. If one needs to determine the name of a mineral, determinative tables are available. What is important is that the student understand how one may discover the various physical and chemical properties of a mineral and then use the consistency of these properties as a guide to identification.

The use of only one mineral will eliminate the confusion that results from using several minerals at the beginning of a unit in mineralogy. Calcite was chosen because of its frequent occurance in various forms and the nature of its physical and chemical properties. A list of the physical properties of calcite can be found in any field guide to rocks and minerals or mineralogy textbook. A few are listed in Table 1 but the list should not be considered complete.

The investigators have found this to be a most successful way of introducing minerals at the high school level and have used this method sev-

Calcite showing double refraction without a polarized lens.

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Table 1. Physical and Chemical Properties of Calcite (Iceland Spar)

Physical			Chemical
Geometrical	Optical	Other	Chemical
Regular Geometry (not amorphous) 3 directions of cleavage not at rt. angles. $\{10\bar{1}1\}$ at 74° 55' Hexagonal Crystal Sys. Rhombohedral Class Habit: Prismatic, Rhombohedral, Scalenohedral Common Twinning $\{01\bar{1}2\}$	Double Refraction (two refractive indicies) Light transmitted is polarized in 2 planes at rt. angles to each other. Optically negative Relief is high in 1.540 oil Extreme birefringence	Hardness = 3 Specific Gravity = 2.7 Streak - white Colorless (Iceland Spar) to variable depending on impurities Luster - Vitreous to Earthy	Formula - $CaCO_3$ Reaction in acid to form CO_2 Reddish-Orange Flame Test Solubility = 0.0014 grams/100 grams H_2O at 25°C

Light from one vibration direction (the lower line) is allowed to pass through, i.e., the prefered direction of the lens.

eral times in their earth science classes.

METHOD

The question naturally arises—Exactly how does the earth science teacher use this method in his teaching? It is felt that if the student is told the properties of the mineral, he will soon forget them, but, on the other hand, if he discovers them himself, they will take on a new meaning and significance.

Each student should have a piece of calcite in his hands. He should attempt to describe the piece as well as he can using any terms that fit (they need not be scientific terms at first). Give him ample time for this task—at least an hour if not more—and make

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The polarized lens allows light to pass through it which is vibrating in the plane of the white dots. This series illustrates what effect the rotation of the polarized lens has on the light viewed through a calcite crystal. This demonstrates that the vibration directions of the two rays are at right angles to each other.

Upon rotation of 45°, the light from both vibration directions is allowed to pass through.

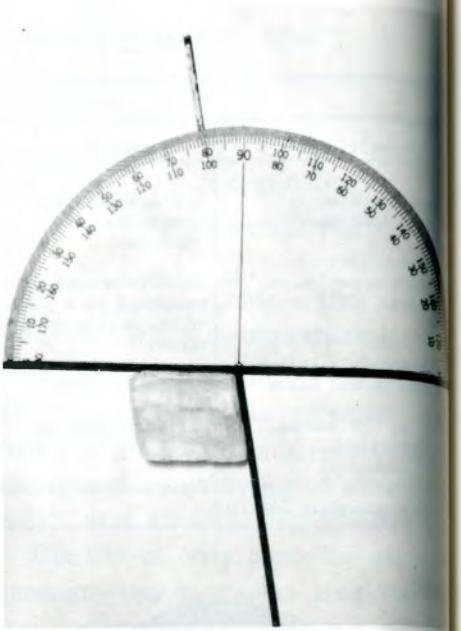
Upon rotation of another 45°, the light from the second vibration direction is allowed to pass through, i.e., the preferred direction of the lens.

equipment and supplies available to him.

The students as a class will have a multitude of observations which will provide days of discussion if careful analysis of these observations are directed by the teacher. All of the properties in Table 1, except perhaps some of the optical properties are likely candidates.

For example, one of the obvious relationships indicated by calcite is the different angles which exist between crystal faces. The constancy of these angles as measured by the students is a perfect opportunity for the students to discover for themselves Steno's law which states: The angles of equivalent faces of crystals of the

Upon rotation of another 45°, the light from both vibration directions is again allowed to pass through.

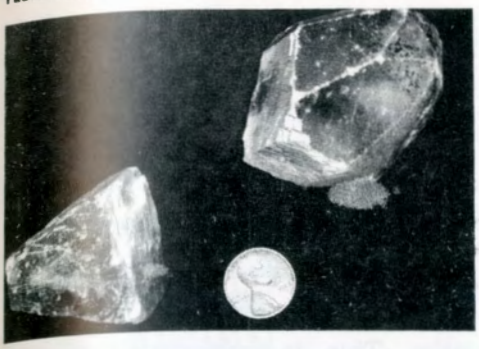


Shows how a student might measure one of the cleavage angles of a calcite crystal.

same substance measured at the same temperature are constant. Also, this allows development of the concept of a regular geometry in minerals.

Once the principles are developed completely for calcite, it is much easier to move to new minerals by applying these principles to the new systems. This general procedure of allowing students to discover for them-

Indicates the tendency for calcite to cleave in rhombohedral shapes maintaining constant interfacial angles.



Shows variation in crystal habit (note the tendency for rhombohedral cleavage on broken surfaces).

selves is most satisfying, and less confusing to both the student and teacher.

NSTA Convention

Now is the time to make reservations for the 15th Annual Convention of the National Science Teachers Convention, March 17-21, 1967.

Regional NSTA meetings are going to be held next fall in Wichita, Kansas (Oct. 12, 13, 14) and Bismarch, North Dakota (Sept. 5-7).

HAWKEYE SCIENCE FAIR - 1967

Veterans Memorial Auditorium in Des Moines will again be the cite for the 1967 Hawkeye Science Fair on April 7 and 8.

Any boy or girl interested in science and attending a public, private or parochial school in grades 7, 8, 9, 10, 11, and 12 and resides in the State of Iowa are eligible for the top awards, including the trip to the International Science Fair in San Francisco, California, May, 1967.

ONLY ONE EXHIBIT MAY BE ENTERED BY A CONTESTANT. ONLY ONE PUPIL SCHOULD PREPARE THE PROJECT. TWO OR MORE NAMES WILL NOT BE ACCEPTED AND THE PROJECT WILL NOT BE JUDGED. Awards will be named by the Hawkeye Science Fair. These will not be in competition with projects entered by pupils in grades 10,11, and 12. Students are eligible to compete for finalist (first place) designated in the Biological and Physical Science at the Hawkeye Science Fair, unless their county has been assigned exclusively to another science fair affiliated and cooperating with the International Science Fair. However, those students who reside in counties assigned to other Regional Science Fairs are eligible for other awards at the Hawkeye Science Fair.

Information is available from Dean C. Stroud, Hawkeye Science Fair, Drake University, Des Moines, Iowa.