quently modified and squeezed into discordance with the foliation of the metamorphic rocks. A magmatic origin of the rare-earth-bearing carbonate rock by differentiation of an alkalic magma from shonkinite to syenite to granite, with a carbonate-rich end product containing the rare elements, is in harmony with the field relations. This late differentiate might have been introduced either as a relatively concentrated magmatic fluid, highly charged with volatile constituents such as carbon dioxide, sulfur, and fluorine, or as a dilute hydrothermal fluid.

J. C. Olson
D. R. Shawe
L. C. Pray
W. N. Sharp

U.S. Geological Survey
Denver Federal Center
Denver, Colorado

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Navajoite, a New Vanadium Oxide from Arizona

Navajoite, hydrated vanadium pentoxide, is a new mineral found in the Monument No. 2 mine, on the Navajo Indian Reservation, Apache County, Arizona, and named in honor of the Navajo Indians. The mine is in a vanadium-uranium deposit just north of Comb Ridge in Monument Valley. The ore occurs in a channel that is filled with Shinarump conglomerate (Triassic) and that extends down through the Moenkopi formation (Triassic) into the DeChelly sandstone member of the Cutler formation (Permian).

The mineral, navajoite, occurs in highly oxidized ore in one part of the Monument No. 2 mine. It impregnates conglomeratic sandstone and silty sandstone, forms seams in the sandstone and crescent-shaped coatings above and below pebbles, and fills small fractures in clay lenses. The associated minerals include only one with V^{+4} and V^{+5}, corvusite; the rest are fully oxidized: tyuyamunite, rauvite, hewettite, steigerite, and limonite.

Navajoite is dark brown, soft, and fibrous, with a silky luster and brown streak. The specific gravity measured on the Berman balance is 2.56. The mineral is optically biaxial, probably negative, has parallel extinction and α is 1.905 ± 0.003, β about 2.02, and γ slightly above 2.02, with pleochroism X yellowish brown, Y yellowish brown, and Z dark brown and parallel to the fiber length. The chemical analysis, by A. M. Sherwood, shows 71.68 percent V_2O_5, 3.08 percent V_2O_4, 3.58 percent Fe_2O_3, 20.30 percent H_2O, 1.20 percent SiO_2, 0.22 percent CaO, and a total of 100.06 percent, and it indicates the formula $V_2O_5 \cdot 3H_2O$. Navajoite is readily distinguished by x-ray powder pattern from hewettite and corvusite, which it may resemble in physical appearance. Although the silky fibers of navajoite are too small for single crystal x-ray study, a rotation photograph of a small bundle of fibers indicated that the unit cell length along the fiber is about 3.65 A (H. T. Evans, personal communication, 1953). A large-scale photograph of the zero layer, obtained by placing a fiber bundle in a powder camera and using chromium radiation, shows many lines. Study of the photograph indicates that the two axes other than the fiber length are not at right angles and that navajoite is probably monoclinic, with the fiber length parallel to the *b*-axis. The best graphical solution of lattice constants found by plotting the reciprocal lattice spacings of the *h0l* lines suggests that $a_0 = 17.43 \pm 0.1$ A, $b_0 = 3.65 \pm 0.05$, $c_0 = 12.25 \pm 0.1$, and $\beta = 97° \pm 30'$. This unit cell would hold approximately 6 formula weights of $V_2O_5 \cdot 3H_2O$.

Navajoite would be an excellent vanadium ore mineral because of its high vanadium content, but unfortunately the mineral is probably not abundant in the ores of the Colorado Plateaus. This is because V^{+5} readily combines with other elements such as Ca, K, Na, Mg, Fe, Al, and U that are commonly present in the ore and because the hydrated vanadium pentoxide may form only under unusually acid conditions.

Alice D. Weeks
Mary E. Thompson
Alexander M. Sherwood

U.S. Geological Survey
Washington, D. C.

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Studies of River Morphology

A number of generalizations concerning the behavior and natural characteristics of river channels have been developed by the U.S. Geological Survey in several recently completed studies of river morphology. Measurements of parameters such as the discharge, suspended load, bed material, velocity of flow, channel slope, and channel shape indicate that many river channels are characterized by an orderly, progressive change of these variables from their headwaters to their mouths. The interaction of the variables and the establishment of a stable channel suggest that the morphology of the stream is controlled by a kind of equilibrium.

This concept of the interaction of a number of variables constituting a kind of equilibrium is the basis of present studies of the origin and operation of meanders, braids, and straight channels. These studies are in four principal parts:

(1) From field measurements of the aforementioned parameters, an effort is made to separate (isolate) the distinguishing physical features of each pattern. For example, in addition to their characteristic islands, braided streams frequently have steeper slopes, wider and shallower channels, and coarser bed material. On the other hand, detailed studies reveal marked similarities in the profiles and patterns of flow in meanders and straight channels.

(2) To understand the mechanics controlling the meander pattern, measurements are being made of the distribution of velocity and discharge in successive cross sections in the direction of the flows.

(3) Where possible, model studies supplement the