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Rutile Mineralization in the White Mountain Andalusite Deposit, California

by

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This report is preliminary and has not been
edited or reviewed for conformity with
U.S. Geological Survey standards and nomenclature.

In May 1977, a one-day field trip was taken to the White Mountain andalusite deposit near Bishop, Calif. (fig. 1). The visit was made to determine whether the area was a potential resource area for rutile (TiO_2) and whether further study was warranted. The extent of rutile occurrence has been suggested by Gross and Parwel (1969); earlier work on the district is by Kerr (1932).

The andalusite deposit is on the west face of the White Mountains just below White Mountain Peak in Jeffery Mine Canyon (figs. 1-3). The area is one of high relief in which steep canyons cut vertically into the country rock. Access to the mine is difficult as there is no existing road. Regional metamorphism is suggested, with quartz-mica schist being the predominant unit in Jeffery Mine Canyon (fig. 1). The geology of the area (Gross and Parwell, 1969) is shown in fig. 1; it consists of a schist unit bounded on the east by quartz monzonite porphyry. The andalusite-quartz "ore zone" and a quartz-topaz mass occur along part of the contact between the schist and the quartz monzonite porphyry. A zone of intense hydrothermal alteration surrounds the mine area and extends over an area of several square kilometers. This zone of alteration has been attributed to the quartz monzonite porphyry and has altered the schist to quartz-sericite schist. This, in turn, has weathered dramatically, leaving the more resistant andalusite-quartz zone and quartz-topaz mass exposed as cliffs (figs. 2, 3). The mine itself is in the cliff face and consists of a series of adits and stopes used to extract pods of high grade andalusite. The andalusite-quartz and quartz-topaz areas are fractured and sheared; secondary quartz and some pyrite occur along the fractures. Rutile was observed in both the andalusite-quartz and the quartz-topaz rocks in the vicinity of the mine. The rutile occurs as fine grains disseminated throughout the rocks. Four samples were taken at the mine and two additional samples were taken along the trail to the mine. Semiquantitative spectrographic analyses of these rock samples are given in table 1. Samples 1-4 were taken from the face of the cliff at the Vulcanite andalusite mine. Sample 1 consists of wall rock from the westernmost stope that was reached. It contains quartz, andalusite, lazulite, topaz?, sericite, and abundant rutile. The rutile occurs as small grains (0.2-0.5 mm in diameter) and clots (as much as 0.5 cm in diameter) scattered throughout the sample. Much of the rutile is very fine grained, and some appears to be filling intergranular spaces. Sample 2 was taken from wall rock near a fracture and contains abundant sericite on some surfaces. It has a more sugary texture and may contain more topaz. Rutile is disseminated throughout in fine grains (0.1-0.3 mm in diameter) and clots (as much as 0.3 cm in diameter) with andalusite and abundant quartz. The fine grain size of the rutile gives the hand specimen a reddish color. Sample 3 was taken from near one of the many secondary quartz veins that fill the numerous fractures in the area. It contains fine grained pyrite (0.1-0.3 mm in diameter) intergrown with the rutile and also has larger clots of lazulite (as much as 1 cm in diameter) together with sericite, topaz?, and abundant quartz. Sample 4 was taken from one of the many fracture zones, and the vuggy appearance of hand specimens appears to be due to leaching. Microscopic examination shows this sample to have a very sugary texture (topaz?) and to contain abundant rutile, apparently concentrated or remobilized along microscopic fractures. In all of these samples the rutile is not in discrete crystals, but always appears as rounded grains or as

Table 1.--Semiquantitative emission spectrographic analyses of rock samples from White Mountain andalusite mine, California

[Values for Fe, Mg, Ca, and Ti reported in percent; all other values reported in parts per million. Lower limits of detection for semiquantitative emission spectrographic analyses: Fe and Ca = 0.05; Ca = 0.02; Ti = 0.002; Mn, B, Cr, Pb, Sn, V, Y, and Zr = 10; Ba, La, and Nb = 20; Cu and Sc = 5; Sn and Th = 100; W = 50. Element-concentrations coded with an N, L, or G, are: N = not detected at limit of detection; L = detected, but below limit of detection; G = greater than upper limit of detection. Analyst: C. Forn]

Sample No.	Fe	Mg	Ca	Ti	Mn	B	Ba	Cr	Cu	La
WM001	0.5	0.02	L	0.7	30	20	1000	70	L	70
WM002	0.1	0.02	0.07	0.3	L	L	700	50	20	200
WM003	0.1	0.02	L	0.3	L	L	1000	70	L	L
WM004	0.05	L	L	0.3	L	L	1500	20	L	L
WM005	0.3	0.07	0.1	0.7	15	10	G5000	70	L	700
WM006	0.5	0.05	L	0.03	L	20	100	50	L	L

Sample No.	Nb	Pb	Sc	Sn	Sr	V	W	Y	Zr	Th
WM001	L	100	15	N	1000	150	L	15	200	N
WM002	N	150	10	N	1500	50	L	10	200	N
WM003	N	30	10	N	300	50	L	L	200	N
WM004	L	L	10	N	200	20	L	15	500	N
WM005	L	150	20	L	3000	100	N	20	300	150
WM006	N	L	L	N	N	100	N	10	10	N

interstitial material. Sample 5 is a float sample and was taken along the trail below the mine. It appears to be typical of the waste rock from the mine as much of this material is seen. It contains abundant rutile and lazulite, together with quartz, sericite, and andalusite. Sample 6 was taken from a prospect pit some distance below the mine and is from an area of diaspore. Much less rutile is seen, although it is present. The sample contains quartz, diaspore, and large books of green mica.

In the course of this field trip, rutile was seen in the andalusite-quartz zone, in the quartz-topaz mass, and in some of the rocks from the altered (sericite) zone. These zones seem to extend north and south and may persist for several kilometers, beyond the zone of porphyry-related alteration. Although the hydrothermal alteration is most noticeable in Jeffery Mine Canyon, several other altered-looking zones are visible in the adjacent canyons to the north and south (figs. 2, 3). A potential for an extended rutile province exists in the area, but further work will be needed to establish this. Further work could also be designed to check whether the rutile-aluminosilicate zone is associated with massive sulfides as at Graves Mtn., Ga.; Willis Mtn., Va.; and Haile and Brewer mines, S.C.

REFERENCES

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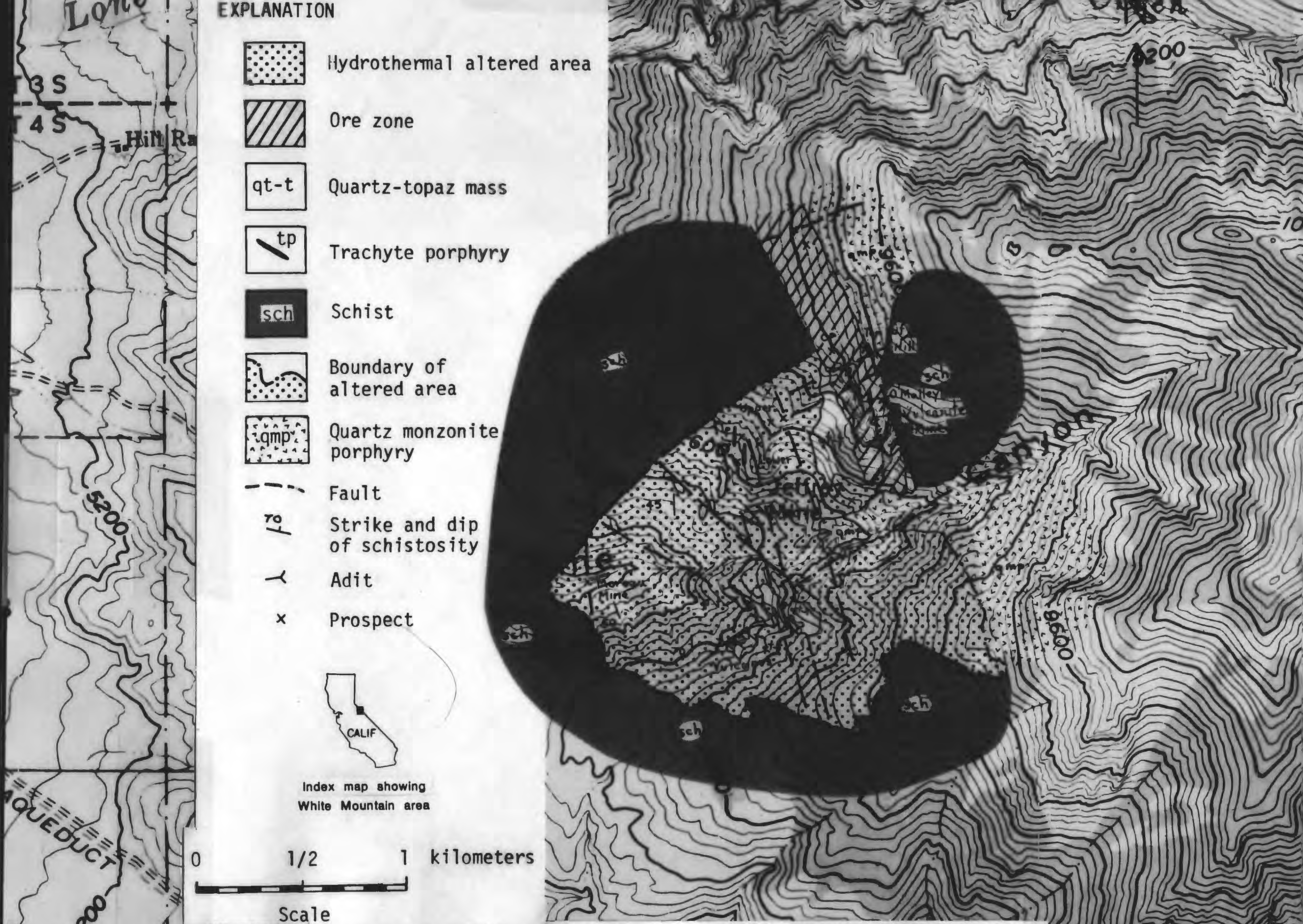

Figure 1.--Geologic map of the area surrounding the White Mountain andalusite deposit. (From Gross and Parwel, 1969.)

Figure 3.--Photograph looking west showing the mountain front uneluding White Mountain Peak and Jeffery Mine Canyon. The schist (sch) is shown in the foreground, and the quartz monzonite porphyry (qmp) and the cliff forming quartz-topaz in the background. The altered zone is shown with possible extensions to the north.

Figure 2.--Photograph of Jeffery Mine Canyon looking west, showing White Mountain Peak, quartz sericite altered zone, schist (sch) in the foreground, cliff forming the ore zone and the quartz-topaz mass (qt-t), and quartz monzonite porphyry (qmp) in the background.