It is still too little known to be applied very far in metamorphism. The crystals in schists are known to be oriented crystallographically as well as elongated, and these experiments have not explained such an orientation. Possibly the change in shape here obtained may be perfectly possible under laboratory conditions, but if such conditions are rare in nature, the applications may not be important. The questions remain: (1) whether during mountain making movements the stresses applied to crystals are localized at certain corners as in the experiments here described, and (2) what other forces acting during metamorphism orient the crystal axes as well as the greater dimensions of the crystal.

PIEDMONTITE FROM LOS ANGELES COUNTY, CALIFORNIA

RUSSELL R. SIMONSON, *University of California at Los Angeles.*

Petrographic studies of some of the metamorphic rocks of the Sierra Pelona schist series[1] have shown that piedmontite occurs as small euhedral crystals in quartz-sericite-biotite schist and in quartzite. The samples studied were obtained near the junction of Bouquet and Texas canyons in northern Los Angeles County.

Although manganiferous schists and quartzites are rather widespread in this region, the piedmontite is restricted to a zone about 300 feet wide and a half mile long adjacent to a quartz diorite dike which is three miles long and over 300 feet wide. The thermal effects and solutions from this intrusive aided the replacement of the laminae of biotite by piedmontite so commonly noted in the thin sections. Some of the quartzites show complete replacement; in such cases little or no biotite is found and parallel rows of pink crystals of piedmontite occupying former bands of biotite give the rocks a reddish cast.

Slides of several samples of the schist and quartzite showed that idiomorphic crystals of piedmontite less than 1 mm. long and 0.5 mm. wide were oriented parallel to the foliation; occasionally when an abnormal amount of the mineral is present radiating rosette-like masses are typical. Some of the crystals have been stretched and the interstitial cracks filled with secondary quartz while others nearby show no signs of deformation indicating several periods of piedmontite deposition. Pleochroic colors are: X = orange to lemon-yellow; Y = amethystine red; Z = carmine. A positive biaxial interference figure showed 2V to be large (70 to 80°). Extinction $X \wedge c$

is $-3°$; refraction and double refraction, high. The associated heavy minerals are manganomagnetite, psilomelane, garnet, titanite, and rutile.

As far as the writer knows, this is the first account of piedmontite from the meta-sedimentary rocks of California. Mayo described two specimens[2] and later a locality[3] of piedmontite in the metamorphic volcanic rocks of Madera County. Other California occurrences (in detrital material) are briefly summarized: Rogers[4] found piedmontite in a quartz porphyry boulder at Pacific Beach, San Diego County; A. S. Eakle[5] mentioned a piedmontite-bearing rock fragment from San Bernardino County; the mineral was reported from the lacustrine sediments of the Lizard area, southern San Joaquin Valley by Reed and Bailey,[6] O. A. Woodford[7] listed piedmontite as a constituent of the San Onofre breccia, and E. Wayne Galliher[8] found it in the bottom sediments of Monterey bay. A pebble of quartz-sericite schist from San Gabriel Canyon, Los Angeles County, found by W. J. Miller and examined by Joseph Murdoch[9] (both of the University of California at Los Angeles) contained piedmontite as an essential constituent.

It is probable that the distribution of this mineral in the Sierra Pelona series is more widespread than the present studies indicate.

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