

plagioclase for heat-treatment care should be taken to ensure the absence of free quartz. Interactions between plagioclases and other substances would possibly be more likely while the feldspar was going through a transition from a low- to a high-temperature structure. This might explain the negative result with the synthetic albite, which already has the high-temperature structure and thus undergoes no transition.

*Dept. of Physics,
The University,
Hull*

W. J. DUFFIN

*Hydrogrossular from the Girvan-Ballantrae Complex,
Ayrshire*

THE occurrence of garnetized gabbro dikes from Byne Hill, one mile south of Girvan, was recorded by Bloxam (1954). These dikes are intrusive in serpentinite and have been considerably altered, containing chlorite, prehnite, pectolite, and garnet. Chemical analysis of the rock (Bloxam, *op. cit.*, p. 527) indicated affinities with the rodingites, and the refractive index and density of the garnet suggested that it might be a hydrogrossular (Hutton, 1943).

Similar dikes of doleritic texture cut serpentinite along the shore near the Sailor's Monument, 600 yards north of Lendalfoot. The marginal phases of the dikes are extensively garnetized and a pure extract of the mineral was obtained. Like the Byne Hill rock, the garnet occurs chiefly in the form of granules ranging in size from 0.05 to 0.01 mm, which are tightly packed and generally pseudomorph plagioclase in association with prehnite and chlorite.

The separated garnet powder is pale grey in colour and isotropic except for inseparable marginal zones, which are weakly birefringent with a refractive index of 1.683. The chemical analysis (below) must therefore be regarded as composite and probably includes uncertain proportions of grossular, plazolite, and hibschite (Hutton, *op. cit.*, p. 179). The chemical analysis and physical properties are comparable with the hydrogrossular of Hutton. The structural formula has been calculated following McConnell, 1942, and Deer, Howie, and Zussman, 1962: SiO₂ 34.59, TiO₂ 0.15, Al₂O₃ 20.81, Fe₂O₃ 0.99, FeO 0.29, MnO 0.05, MgO 1.20, CaO 36.13, Na₂O 0.01, K₂O nil, H₂O⁺ 4.91, H₂O⁻ 0.36, P₂O₅ nil, total 99.49 %; sp. gr. 3.30, *n* 1.683 to 1.712, *a* 12.08 Å; atomic ratios to 24 oxygen, Si 5.025, H/4 1.260 (sum 6.285), Ti 0.001, Al 3.563,

Fe ··· 0.108 (sum 3.672), Fe ··· 0.035, Mn 0.006, Mg 0.259, Ca 5.623 (sum 5.923).

*Dept. of Geology,
University College,
Swansea*

T. W. BLOXAM

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Magnetite colloid in ore mineralogy

WHILE studying sulphide ores from the English Lake District, in which considerable amounts of fine-grained pyrrhotine were present, it was found that application of magnetite colloid to the polished surfaces facilitated identification and photography of the pyrrhotine, and the study of its relations with other minerals.

The technique was introduced to the writer by Miss Sylvia Rushton, of the Department of Physics, Nottingham University: it has been used extensively by physicists studying magnetic materials and domain structures, but it has not, to the writer's knowledge, been previously applied to ore mineralogy.

On a large scale, the use of iron filings in elementary experiments on magnetism is known to all; magnetite colloid acts in a similar manner. On applying the colloid to a polished surface, the magnetite particles congregate over magnetic minerals (pyrrhotine in this case), coating them with a brown layer, and leaving the other minerals clear: the colloid is here being used as a stain. Colloid may also be used on hand specimens which have been smoothed with 600-mesh 'Carborundum'; the staining so produced is visible to the naked eye.

Applied to microscopic examination of polished surfaces, the method is capable of many other uses, besides identification by staining. Domain structures in the pyrrhotine (fig. 1, A) are usually well marked, and may be used in the same way as any other directional structure in studying replacement (fig. 1, B and C). A permanent record of the distribution of magnetic minerals, and of their domain structures, may be obtained by taking a cellulose tape 'peel' of a colloid-coated surface that has been allowed to dry. Dr. F. Vokes (personal communication) has suggested