A note on the occurrence of geocronite and boulangerite in the Rajpura belt, Udaipur district, Rajasthan, India[1]

Two rare sulphosalts have recently been identified in the drill core samples of a Precambrian base metal deposit located at Rajpura (24° 58′ N., 74° 07′ E.) in the Udaipur district, Rajasthan.

Geocronite occurs as a massive granular aggregate associated with minor galena and disseminated arsenopyrite in a matrix of pyroxene, tremolite, quartz, and calcite. The mineral is lead grey with a pale brownish shade and shining metallic lustre. H. about 3 (Moh's scale), sp. gr. > 6. The mineral takes excellent polish; in reflected light it is white with a pale purplish tint. Reflectance pleochroism is weak: yellowish-white to greenish-white. Anisotropism is strong with polarization colours of yellowish-grey to greenish-grey. Lamellar twinning defined by lamellae of uniform thickness is characteristic. Extinction is oblique with respect to the twin lamellae. Reflectivity 40·9 (in air, white light). Etch reactions HNO_3—effervesces feebly, stains black; HCl—stains brown; KCN, $FeCl_3$, KOH, and $HgCl_2$ give negative results. Microchemical tests indicate lead, antimony, arsenic, and sulphur. The X-ray powder pattern is an excellent match with that recorded by Douglass *et al.* (1954),[2] and indexed well with *a* 8·94 Å, *b* 31·92 Å, *c* 8·48 Å, β 118° 28′.

Boulangerite occurs as needles and fine prismatic grains within galena in a medium-grained assemblage of galena, tetrahedrite, chalcopyrite, and pyrite associated with gangue minerals like pyroxene, tremolite, and calcite. The mineral is lead grey with a pale greenish shade and shining metallic lustre. It occurs in intimate association with galena and a pure fraction of the mineral could not be separated. The mineral takes excellent polish and is distinctly pleochroic; galena white to greenish-white. Anisotropism is strong: light tan, grey, yellowish-white. Twinning is absent. Reflectivity 36 (minimum) and 40·5 (maximum) (in air, photo-cell, white light). Etch reactions are as follows: HNO_3—effervesces, stains black; HCl—stains faintly grey; KCN, $FeCl_3$, and $HgCl_2$—negative. Micro-chemical tests are positive for lead, antimony, and sulphur.

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[2] The names geocronite and jordanite on A.S.T.M. cards 8–94 and 11–100 were interchanged. Both sets of data were from Douglass *et al.* (1954).

The X-ray pattern agreed well with that of boulangerite given in A.S.T.M. card (9–470) and the cell dimensions for boulangerite were calculated as $a = 21{\cdot}54$ Å, $b = 23{\cdot}50$ Å, $c = 8{\cdot}10$ Å, $\beta = 101^\circ\ 15'$.

A *chemical analysis* of the geocronite was carried out as follows:

The specimen was decomposed with a mixture of HCl–H_2SO_4–HNO_3. Pb was separated as $PbSO_4$ along with other insolubles. This was filtered and the residue was treated with ammonium acetate acetic acid mixture to remove $PbSO_4$, and the insolubles ignited and weighed. Pb was estimated as chromate in the usual manner. From the filtrate As, after reduction with SO_2, was removed by H_2S at 10 N acidity. As_2S_3 was dissolved in NaOH containing H_2O_2 and As was determined as magnesium pyroarsenate. From the filtrate after removing arsenic Sb was precipitated as Sb_2S_3 by passing H_2S at 1 N acidity. The Sb_2S_3 was treated with H_2SO_4–$KHSO_4$ and fumed to copious fumes to obtain a solution of Sb^{3+}. Sb was then estimated by titration with $KBrO_3$ using methyl orange as an indicator. Sulphur was estimated as usual by fusion with Na_2O_2.

The results were Pb 63·34, As 3·01, Sb 10·98, S 16·15, insolubles 6·10, total 99·58 %.

After deducting the insoluble, which was found to be silica, present as impurity in the mineral, the other constituents were recalculated to 100 %, giving Pb 67·77, As 3·21, Sb 11·74, S 17·28.

This agrees well with geocronite, $Pb_9(As,Sb)_4S_{15}$ (Douglass, Murphy, and Pabst, 1954). A chemical analysis of the boulangerite could not be carried out as a pure fraction was not available.

This appears to be the first reported occurrence of geocronite in India.

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Fortran IV programme for molecular norm calculation

A fortran iv programme has been written for the calculation of molecular norms of igneous rocks according to the method of Barth (1962). Input to the programme consists of N (the number of analyses to be