

hedra, the presence of BeO_4 , AlO_4 , and SiO_4 tetrahedra in the framework and the distortion of the SiO_4 tetrahedra do not lend themselves to an unambiguous interpretation of the thermal expansion and its anisotropy in terms of the crystal structure.

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Columbite from St. Austell, Cornwall

GUNHEATH PIT, $4\frac{1}{2}$ km NNW of St. Austell, lies within the kaolinized part of the granite and the workings have exposed many pegmatite veins 5 to 20 cm thick in the north face. An investigation of these during 1972 and 1973 revealed columbite for the first time at this locality, in several vertical veins striking NNE. The mineralogical composition of these veins is variable, the columbite usually occurring as small subhedral platy crystals up to 5 mm across, either singly or as radiating aggregates, with microcline, quartz, and zinnwaldite. Accessory minerals are apatite, tourmaline, topaz, opal, arsenopyrite, and turquoise. The largest fragments of columbite, reaching 2 cm in size, occurred in a vertical lens of unusual composition, consisting entirely of quartz, 'gilbertite', and apatite, with rare accessory torbernite.

An electron-probe analysis was obtained from a 2 mm fragment of the columbite using the Geoscan instrument at the British Museum (Natural History). The elements were measured relative to pure metal standards, apart from tin, for which a pure specimen of cassiterite was used. After computer correction for matrix effects the analysis obtained was Nb_2O_5 55.91, Ta_2O_5 17.01, TiO_2 4.99, WO_3 3.65, FeO 14.98, MnO 3.60, Sc_2O_3 0.80, SnO_2 0.11, total 101.05%. The density, determined with a Berman balance, is 5.62 g. cm^{-3} . Recalculation of this analysis to a unit cell containing 24 oxygen atoms gives $(\text{Fe}_{2.96}\text{Mn}_{0.72}\text{Sc}_{0.16}\text{Sn}_{0.01})_{\Sigma 3.85}(\text{Nb}_{5.97}\text{Ta}_{1.09}\text{Ti}_{0.89}\text{W}_{0.21})_{\Sigma 8.16}\text{O}_{24}$. The mineral is noteworthy for the relatively high level of substitution of Ti and W for (Nb, Ta), and of Sc for (Fe, Mn). Scandium has been reported in a number of columbite-tantalites and ixiolites (Neumann, 1961; Haapala *et al.*, 1967; von Knorring *et al.*, 1969; Borisenko *et al.*, 1969) and we believe it to be a more widespread minor constituent of columbites than has hitherto been suspected. The X-ray powder pattern obtained from a sample of the mineral was in excellent agreement with those from other columbites and tantalites. In view of the close approach to site stoichiometry of the formula given above, cation disorder

is not suspected and we therefore classify the mineral as a columbite, rather than ixiolite (Nickel *et al.*, 1963).

Gunheath Pit is the third locality recorded for columbite in the British Isles. von Knorring (1951) reported it in the Meldon aplite, Devonshire, and later, in the Chiapaval pegmatite, South Harris, Outer Hebrides (von Knorring and Dearnley, 1960). The St. Austell occurrence shows some similarities with other pegmatitic columbites in that the area is considerably enriched in Li. At Meldon, however, the mineralization is considered by von Knorring to be possibly of pneumatolytic origin, whereas at Gunheath Pit it is clearly pegmatitic, as are relatively rare occurrences of cassiterite and sulphides in the same area.

A specimen from this find is preserved at the British Museum (Natural History) as BM. 1975. 548.

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Columbite from Mashad Pegmatites, a first record in Iran

COLUMBITE has been found for the first time in Iran in the pegmatites of the Mashad area of Khorassan. The approximate coordinates for the locality are: 36° 09' N, 59° 49' E. In this area the main rock formation is a large granitic intrusion with an outcrop of more than 100 km². Numerous aplite veins and pegmatite bodies are observed penetrating the granite, some of them with sharp boundaries to the host rock and forming a more or less dense network of veins and veinlets. Others pass gradually into the granite.

The pegmatites contain mostly pink-coloured microcline, quartz, albite, some muscovite, and in places schorlrite. Beryl has also been found by the writer in two locations, the first in the form of crystals attached to the wall of a miarolitic cavity and the second as large crystal aggregates associated paragenetically with the above-mentioned minerals. Columbite was