

A second occurrence of killalaitite

KILLALAITITE was first discovered (Nawaz, 1974) at Inishcrone, Co. Sligo, Ireland. It occurred in association with afwillite and calcite in veins and cavities of spurrite-rich rocks. Nawaz described the morphology and optical properties and suggested a unit cell, which, however, was not supported by the single-crystal work of Taylor (1977), who determined the crystal structure.

The second occurrence of killalaitite is noted at Carneal, Co. Antrim. The chalk-dolerite contact here (Sabine and Young, 1975) is mineralogically similar to those at Scawt Hill (Tilley and Harwood, 1931) and Inishcrone (Nawaz, 1975). At the latter locality Carboniferous limestone rather than chalk is involved.

At Carneal the killalaitite occurs in larnite-rich rocks. They are fine grained, hard and compact, dark-coloured and are coated with a white to brownish-white plombierite crust several millimetres in thickness. In thin section they are comprised of about 80% by volume of larnite, the remainder being magnetite, perovskite, spinel, and spurrite, and veinlets and cavities of secondary minerals (see below). Larnite, average size 0.1 mm, constitutes a granular polygonal structure in which the remaining primary minerals occur either interstitially or poikilitically.

As noted above the larnite-rich rocks contain numerous narrow veinlets and cavities filled with secondary minerals. The veinlets are zigzag and branch out with widths varying between 0.1 and 2.0 mm. Most cavities are generally spherical or somewhat elongated and vary in size between 0.2 and 2.0 mm. Both the veinlets and cavities are lined by plombierite and contain the mineral associations:

plombierite-killalaitite-afwillite
plombierite-afwillite-portlandite-killalaitite
plombierite-afwillite-killalaitite-calcite.

Killalaitite, largest grains 0.3 × 0.1 mm, duplicates the habit, twinning, and optical properties of the Inishcrone material (Nawaz, 1974) and shows a high positive relief over the colourless, isotropic base in which it occurs.

Afwillite occurs either as anhedral-bladed crystal aggregates with portlandite occupying interstices or as radiated-bladed aggregates set in calcite matrix. Grain size is variable; the longest crystals are 0.5 mm in length.

Plombierite is taken to include all natural hydrous calcium silicate gels whose CaO:SiO₂ ratio varies between 0.8 and 1.5. At least three varieties of plombierite gel are present in Carneal rocks (fig. 1). A clear variety, in immediate contact with larnite and pseudomorphing it, has the lowest refractive index. It preserves the relict twinning inherited from larnite and shows low birefringence. A second variety, which is pale brown and turbid, contains numerous microscopic inclusions. It has low birefringence, no twinning, and its refractive index is the highest. A third variety, which occurs in the central zones, is clear and almost isotropic. It is associated with other secondary minerals such as killalaitite, afwillite, and portlandite. Its refractive index is slightly lower than that of the second variety.

Portlandite occurs intergrown with afwillite from which it is distinguished by slight turbidity, lower refractive index but higher birefringence, a perfect basal cleavage, and uniaxial negative character. Its extinction and cleavage are similar to those of micas but its birefringence is lower than micas of comparable refractive index. Sections of larnite of comparable birefringence

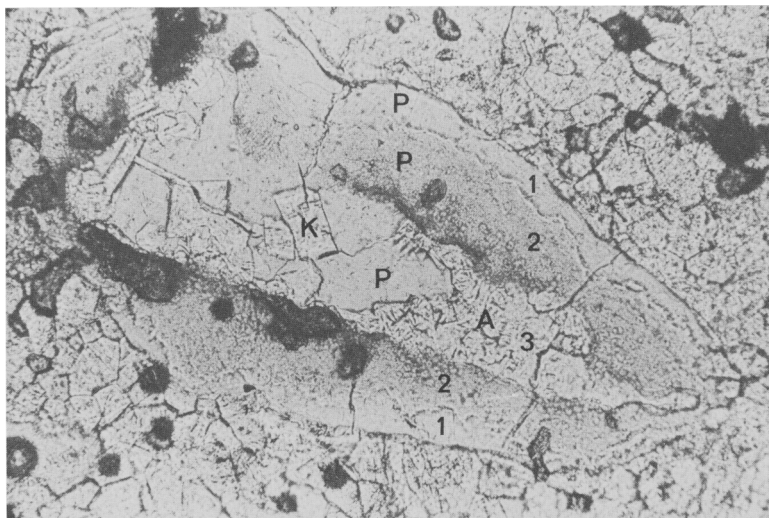


FIG. 1. Larnite-spinel rock, specimen no. J114, from Carneal, Co. Antrim, showing a zoned, infilled cavity of length 0.9 mm. Zone 1—plombierite gel (P), pseudomorphs after larnite, with relict twinning. Zone 2—plombierite gel, turbid, showing high relief and relict spinel grains. Zone 3—plombierite gel with killalaita crystals (K), awillite (A), and minor portlandite (interstitial with A).

are also length slow but have much higher relief and poorer cleavage. In the sections examined it is anhedral, flaky with variable grain size, length or width not exceeding 0.2 mm.

Sabine and Young (1975) noted portlandite in Carneal rocks but not awillite or killalaita. Tilley (1933) and McConnell (1955) observed the awillite-portlandite assemblage and it should be interesting to see if their thin sections contained killalaita as well. In his paper Tilley noted that portlandite is easily replaced by calcite. This could explain portlandite not being found at Inishcrone where awillite, killalaita, and calcite are associated.

As at Inishcrone the association of awillite and killalaita is significant. All the individual minerals are known to have been synthesized under low-temperature hydrothermal conditions (Heller and Taylor, 1956; Taylor, 1977), but relative stability conditions have not been determined. Due to lack of experimental data or lack of its applicability it can only be said that the minerals are a produce of low-temperature hydration of larnite.

McConnell (1954, 1955) and Long and McConnell (1959) have shown that the hydration of larnite (and bredigite) occurs by the initial formation of a high-lime gel, CaO:SiO₂ ratio 1.5, in which the excess calcium is present as calcium hydroxide. Low-lime gel, CaO:SiO₂ ratio 0.86, is produced by excretion of the calcium hydroxide. Chemical, refractive index, and density data on three natural gels (McConnell, 1955, Table 1) may be correlated thus: increasing Al₂O₃ and Fe₂O₃ content increases the refractive index and density; increasing CaO:SiO₂ and H₂O:SiO₂ ratios decrease the refractive index and density.

Assuming that the hydration of larnite progressed from the centre of cavities towards the margins by diffusion of hydrothermal fluids, and that the H₂O:SiO₂ ratio of the plombierite gels is comparable, then their refractive index must be a function of their CaO:SiO₂ ratio and the Al₂O₃ and Fe₂O₃ contents. Taking into account the observed variation in the refractive index and other physical characteristics of the Carneal plombierite gels it may be concluded that: Plombierite of Zone 1 has a high CaO:SiO₂ ratio and it is equivalent to the high-lime gels of Long and McConnell (1959). Plombierite of Zone 2 has a lower CaO:SiO₂ ratio but contains some Al₂O₃ and Fe₂O₃. Plombierite of Zone 3 is similar to that of Zone 2 except that it is

poorer in Al_2O_3 and Fe_2O_3 . Afwillite, killalaite, and portlandite of the Zone 3 are hydrothermal products of a former gel of Zone 1 type, which formed in accordance with the probable reaction, $[\text{Ca}_2\text{SiO}_4]_4 + n\text{H}_2\text{O} = [\text{Ca}_3\text{Si}_2\text{O}_7 \cdot x\text{H}_2\text{O}]_2 + [\text{Ca}(\text{OH})_2]_2$, the empirical formula $\text{Ca}_3\text{Si}_2\text{O}_7 \cdot x\text{H}_2\text{O}$ being common to high-lime gel, afwillite, and killalaite.

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Darapskite, $\text{Na}_3(\text{NO}_3)(\text{SO}_4) \cdot \text{H}_2\text{O}$, a new occurrence, in Texas

DARAPSKITE, $\text{Na}_3(\text{NO}_3)(\text{SO}_4) \cdot \text{H}_2\text{O}$, first described by Dietze (1891), is a widespread mineral in the Chilean nitrate deposits where it occurs alone and with other saline minerals in veins, pods, cementing material, and cavities in the nitrate ore. Ericksen and Mrose (1970) very briefly mention its presence in saline materials from caves in the limestones of Funeral Mountains, Death Valley, California, but give no further details of that occurrence. This paper is the first detailed description of darapskite as a cave mineral.

Darapskite occurs intimately mixed with halite in Flower Cave, one of a group of caves located at the southern end of Big Bend National Park, Texas, U.S.A. For details on the specific location of the occurrence and collecting restrictions, contact Big Bend National Park, Texas 79834, U.S.A. The cave is developed in the Santa Elena limestone, which is a massive, thickly bedded, dense, cherty, grey, escarpment-forming limestone of Lower Cretaceous (Comanchean) age (Maxwell and Dietrich, 1965). The eastern exposure of Santa Elena limestone is 60-70 m thick and contains about a dozen caves besides Flower Cave.

The Flower Cave entrance is a broad, slightly ascending, crawlway about 15 m long which terminates in a chamber 2 m in height and 3 m in diameter. On the back wall of this room numerous cave flowers up to 8 cm in length protrude from the bedrock along a horizontal bedding plane. The flowers are white and opaque and consist of radiating 'petals', which curve away from the centre of the flower. These 'petals' consist of alternating growth layers of translucent darapskite and opaque halite, which are oriented parallel to one another, as well