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Churchite from the Mt Weld carbonatite laterite, Western Australia

CHURCHITE, the hydrous yttrium phosphate, has been reported from weathered chert, shale and limestone sequences and weathered granite pegmatite and vein deposits (e.g. Claringbull and Hey, 1953; Barstow and Cooper, 1982). This note documents the occurrence of secondary, supergene churchite formed during laterization of the Proterozoic Mt Weld carbonatite, Western Australia (Willett *et al.*, 1986). Long-term, deep weathering processes during the Mesozoic–Cainozoic caused pseudomorphic replacement and decomposition of primary igneous carbonatite minerals and subsequent recrystallisation of secondary, supergene minerals. The leaching and reprecipitation processes created a thick overburden overlying unweathered carbonatite rocks. Churchite occurs within the laterite in association with other *REE*- and P-bearing, secondary, supergene minerals including goyazite, gorceixite, florencite, crandallite, monazite, apatite and cerianite. Similar parageneses have been reported from numerous weathered carbonatite products (e.g. Rose *et al.*, 1958; Coetzee and Edwards, 1959; Frondel and Marwin, 1959; Deans, 1966; Bloomfield, 1973; Sandvik and Erdosh, 1977; McNeil, 1979).

Churchite is a minor secondary mineral in the weathered carbonatite residuum. The mineral occurs mainly as acicular radiating crystals in a microcrystalline form (Fig. 1) which readily breaks up into slime-sized particles. It is present as void fillings in crandallite-group minerals and as crustifications on 'limonite' aggregates, weathered magnetite and crandallite-group mineral grains. Fine-grained intergrowth with 'limonite' has been observed in places.

X-ray identification of the churchite was undertaken with a Gandolfi camera. Electron microprobe analyses of churchite revealed major amounts of Y and P and minor levels of *HREE*, *LREE* and Ca.

The observed textures, the present paragenesis of other secondary, supergene minerals and the friable nature of the reported churchite preclude a residual origin and so far no primary igneous xenotime has been observed. Furthermore, the associated monazite occurs as friable, earthy material and commonly replaces secondary hexagonal apatite. Such earthy monazite has been reported from deeply-weathered carbonatites and granite pegmatites and was interpreted as a mineral of secondary, supergene origin (Rose *et al.*, 1958; Deans, 1966; Mitchell *et al.*, 1976).

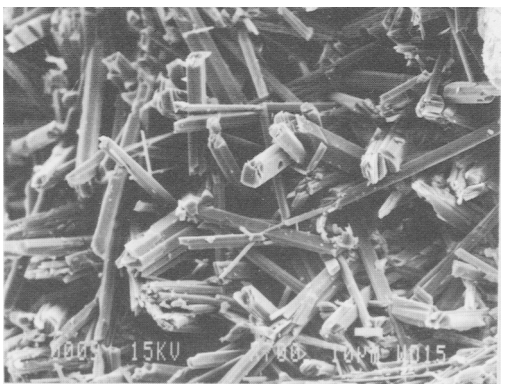

FIG. 1. SEM picture showing microcrystalline supergene churchite crystals.

The genesis of supergene churchite at Mt Weld is related to the extensive laterization, whereby numerous elements including Y and *REE* experienced extreme mobility and subsequently formed a variety of secondary, supergene minerals including churchite.

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