surrounded by one containing abundant orthoclase, albite, or muscovite. The central portion is often occupied by a vein containing various ore minerals, but similar alteration profiles have been observed around aplite and pegmatite intrusions. Two examples of alteration associated with ore mineralization are shown (figs. 1 and 2).

There seems little doubt that zoned alteration haloes are caused by diffusion of components in the fluid-filled, intergranular pore-spaces of the wall-rocks adjacent to a channelway (Korzhinskii, 1946). Studies by the author suggest that the feldspar and mica-rich zones are often the first to develop and that these zones migrate away from the fissure. The growth of a tourmaline-rich zone is a later phenomenon and results in the superimposition and eventual obliteration of the earlier assemblages.

Rocks which appear identical to luxullianite often form in these alteration environments. In these cases the pink feldspar can be either orthoclase or albite. The example of luxullianite described by Lister must not therefore be regarded as an atypical product of postmagmatic alteration in the region. Furthermore, her chemical analyses demonstrate that luxullianite is not formed by the arrested tourmalinization of a granite (Wells, 1946). The growth of secondary orthoclase also appears to be important and a combination of tourmalinization and K-metasomatism seems likely.

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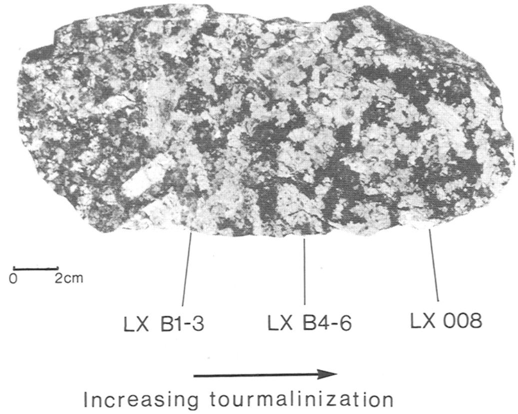
Luxullianite *in situ* within the St. Austell granite, Cornwall—a reply

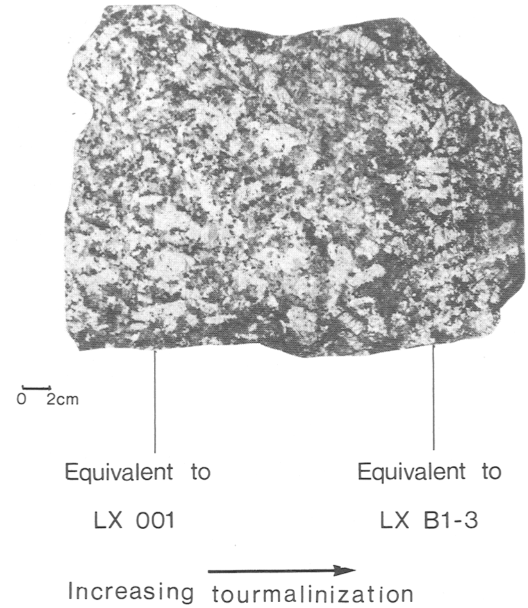
I SHOULD like to thank Dr Alderton for his interesting comments. It is certainly apparent that in the example under consideration, one is observing the combined effects of tourmalinization and K-feldspathization.

Alderton reports alteration profiles in which two separate events may be recognized, namely the development of feldspar- and mica-rich zones followed by the superimposition of a central tourmaline-rich zone. The present example, however, lacks the sharply defined zone boundaries visible in Alderton's illustrations; instead, a strongly megacrystic texture prevails across the transition zone from granite into luxullianite (figs. 1 and 2). Furthermore, the replacement phenomena observed in transitional material indicate direct substitution of tourmaline (and chlorite) for minerals present in the unaltered granite, rather than for those of a K-silicate alteration assemblage.

The partial chemical analysis of LX B4-6 (advanced transition zone) clearly shows an unusually high K concentration; the composition of this sample is consistent with a mineral assemblage containing, for example, about 75% orthoclase, and 7% tourmaline, with the remainder comprising micas, quartz, and accessories. On the basis of field and petrographic evidence, it is suggested that two alteration processes may have been involved, but that these took place simultaneously as manifestations of one and the same event. The K-bearing component of a single hypothetical metasomatic fluid may simply have permeated further from the vein centre than did the tourmalinization agents, thus producing a peripheral zone of K-feldspathization.

The alkali depletion anticipated by Alderton in cases of 'appreciable tourmalinization' (para. 2) has not fully been realized here, since muscovite and alkali feldspar persist into the centre of the luxullianite veins. The influx of K in association with the





FIGS. 1 and 2: FIG. 1 (*left*). Transition zone from granite into luxullianite, showing megacrystic texture of both transitional material and luxullianite itself. There are no sharply defined zones of alteration such as Alderton illustrates. FIG. 2 (*right*). Transition zone from unaltered granite into the outer portion of a luxullianite vein, showing large K-feldspar megacrysts throughout.

agents of tourmalinization has evidently cancelled out any decrease in alkalis resulting from the replacement of micas (biotites) and feldspars.

It seems clear both from Alderton's remarks and from the present author's observations that luxullianite is not unique, and that a great variety of superficially similar rock types do occur in south-west England. Some examples are directly associated with metalliferous mineralization (e.g. as part of wall-rock assemblages), while others, including the veins at Luxulyan, occur in apparent isolation. Although the development of the characteristic luxullianite textures is relatively rare, the combination of tourmalinization and K-metasomatism would appear to be a fairly common one.

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The retrogressive breakdown of orthopyroxene in granulite-facies rocks, Sutherland

RETROGRESSION is extremely common in the acid granulite facies rocks of the Lewisian complex. In various mineralogical studies (Sutton and Watson, 1951; Beach, 1973; Sheraton *et al.*, 1973) it has usually been stated that biotite or biotite and hornblende are the replacement products after orthopyroxene. This paper shows that there is a sequential development of several minerals before these biotite and hornblende end-products.

In the freshest samples the acid granulites are composed of unzoned antiperthitic plagioclase (An_{30-45}), hypersthene (En_{41-48}), clinopyroxene, quartz, and ore, with greatly subordinate K-feldspar, apatite, zircon, and biotite.

The first indication of retrogression is a thin kelyphitic rim of granular blue-green hornblende around both pyroxenes. With increasing thickness this rim often has inclusions of quartz blebs together with a slight inward colour change to less pleochroic amphibole.