SHORT COMMUNICATIONS

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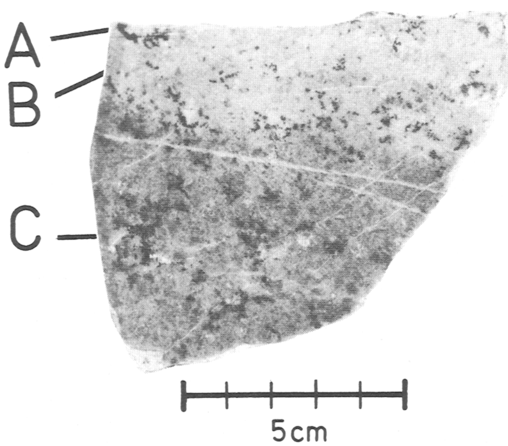
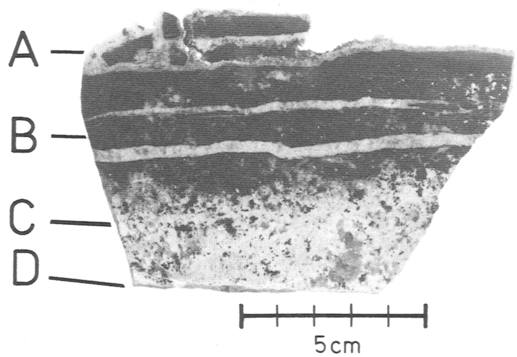
Luxullianite *in situ* within the St. Austell granite, Cornwall—a discussion

LISTER (1978) has recently described some exposures of luxullianite—a striking rock consisting predominantly of black tourmaline, pink K-feldspar, and quartz. The relationships between this rock type and the host granite are particularly interesting but need some clarification.

Previous authors have tended to generalize over chemical gains and losses during rock alteration, without being specific as regards the mineralogical changes involved. Such changes are particularly important when discussing the role of alkalis during tourmalinization. If a granite suffers appreciable tourmalinization, a depletion in both Na and K should be seen, as micas and feldspars are replaced. The alkali variations recorded by Lister in the transition from luxullianite to unaltered granite do not show this, so tourmalinization cannot have been the sole alteration process in operation. The Na content does decrease (excepting the modest amount fixed in the tourmaline), which is consistent with breakdown of plagioclase feldspar. However, even allowing for slight changes in density, it is clear that both the luxullianite and the 'transition zone' have experienced extensive addition of K, presumably reflected by the growth of K-feldspar. Thus 'an alkali exchange mechanism' is not sufficient to account for the alkali variations. In fact the content of 13.43% K_2O in LXB4-6 indicates that there would be approximately 80% $KAlSi_3O_8$ by volume in this sample (and more if muscovite or biotite were present). Two alteration processes have therefore occurred: tourmalinization, and the growth of secondary K-feldspar (i.e. K-silicate alteration—Meyer and Hemley, 1967).

The chemical data clearly reveal that the alteration profile is zoned. Such zoning in alteration profiles adjacent to hydrothermal veins is a common feature, both in the south-west England region (Alderton, 1976) and in other metallogenic provinces (Meyer and Hemley, 1967). In the granites of south-west England, the most common type consists of a tourmaline-rich assemblage





FIGS. 1 and 2: FIG. 1 (*left*). Zoned alteration profile in granite from Carn Gloose, St. Just, Cornwall. A: central fissure containing coatings of orthoclase and wolframite, B: quartz, orthoclase, and minor tourmaline, C: quartz, muscovite, and minor tourmaline (i.e. greisen). FIG. 2 (*right*). Zoned alteration profile in granite from near Hay Tor quarry, Dartmoor, Devon. A: brecciated vein infill of quartz and sphalerite, B: quartz, tourmaline, and apatite, C: quartz, orthoclase, and minor tourmaline, D: Sericitized granite with minor tourmaline.

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