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## B5 Gurnard's Head

[SW 432 387]

### Highlights

This site is one of the few that shows a continuous gradation within a dolerite body from a massive, lower part to a pillowed top. Metasomatic effects, associated with the nearby Land's End Granite, are also well developed.

### Introduction

The rocky peninsula of Gurnard's Head shows rocks in the metamorphic aureole of the Land's End Granite. Although much of the volcanic development within the Upper Devonian is recorded by classic exposures of pillow lavas; they can often be spatially associated with more-massive, intrusive, sheet-like doleritic bodies (Taylor and Wilson, 1975). Only in some cases, such as at Gurnard's Head, can these be seen to be directly related via vertical gradation from massive sheets to pillowed top.

### Description

Gurnard's Head is topographically divided into two by a wide grassy hollow underlain by a metasedimentary horizon that separates the two greenstone masses to the north and south (Figure 4.15). At the site, the contrast between the type and level of emplacement of the two bodies may be seen. The southern greenstone is massive throughout, and although its contacts with the adjacent sediments are heavily sheared, it cuts the sedimentary lamination and was emplaced as a relatively late intrusive sheet. The northern greenstone rests conformably on the metasediments, below which are partially adinolized pelites and semipelites. The contact can be traced across the neck of the headland dipping at about 25° NNW; it is typically sheared and impregnated with radiating groups of hydrothermal, green amphibole. The base of the body is composed of a massive sheet-like intrusive which changes upwards to a crudely pillowed and vesiculated top. This implies emplacement at a high level, with the topmost magma batch in contact with water. The lenticularity of some of the pillows is partly a consequence of later shearing (Figure 4.16).

### Interpretation

Both of the Gurnard's Head greenstones (which originally ranged from dolerite to basalt) lie within the Land's End Granite aureole, and they are now fine-grained ilmenite–plagioclase–actinolite hornfelses. The later replacement of contact-metamorphic amphibole by biotite implies the migration of K-bearing hydrothermal fluids across the width of the aureole from the granite source about 1000 m away. This example of externally derived fluids metasomatizing the greenstone is in contrast to the localized movement (within restricted shear zones) of Ca-rich fluids initially derived from the greenstone. This latter effect is represented by horizons within the pillowed greenstone, which contain white bands of diopside that replace the actinolite and probably represent the mobilization of Ca from original calcite-filled vesicles.

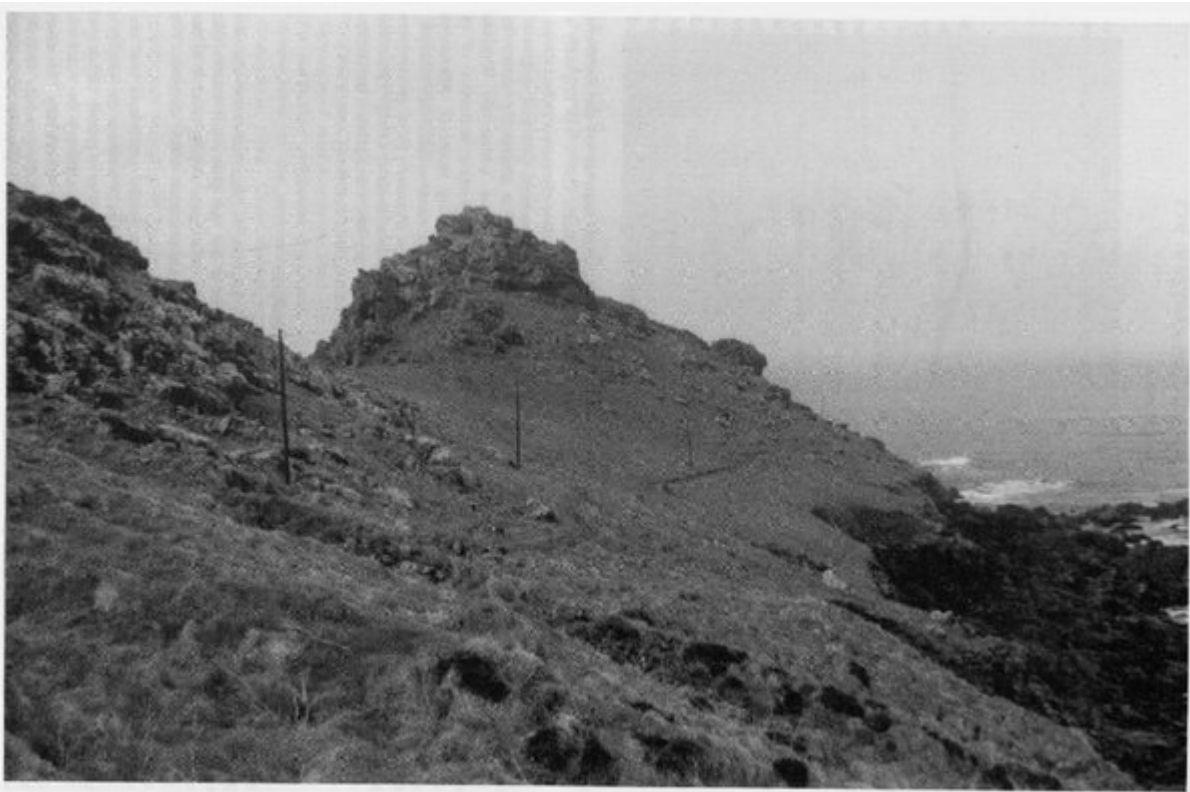
The few chemical analyses of the northern greenstone body indicate that it was originally a moderately incompatible-element-enriched tholeiite, typical of the southern Cornwall magmatic group (Figure 4.2). It is chemically similar to other metatholeiite lavas within the Penwith Peninsula with a composition indicative of an intraplate eruptive setting. However, differences in some incompatible-element ratios (for example, Zr/Y) imply that the Gurnard's Head greenstones and the nearby pillow lavas at Clodgy Point and Botallack Head are not comagmatic, but represent separate volcanic centres (Floyd, 1984).

### Conclusions

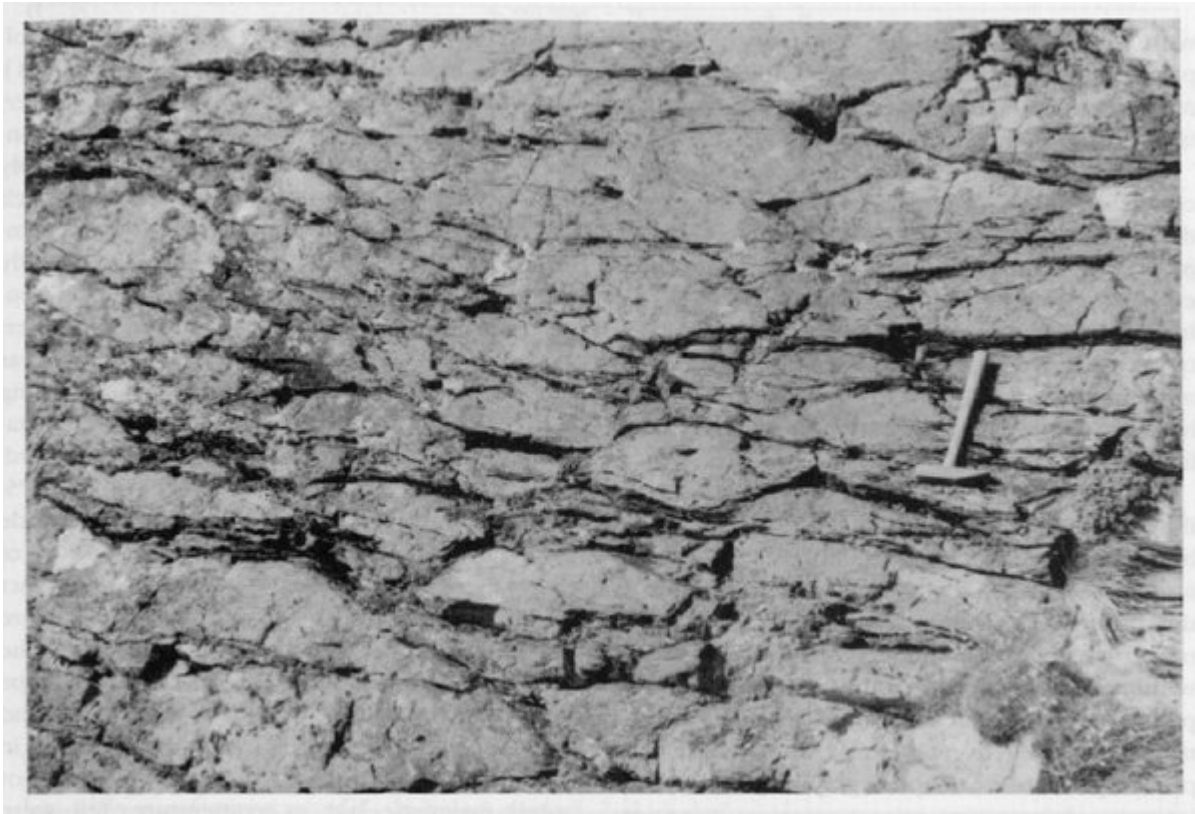
The main interest in the site concerns the emplacement of the two greenstone masses that were intruded at different depths relative to the contemporaneous sediment–water interface. The change from sheeted to pillowed morphology indicates that the northern greenstone was emplaced near the interface, whereas the southern greenstone was intruded at a greater depth and within the sediment pile. Although the volcanics of this site are similar chemically to other metatholeiites in the magmatic province of south Cornwall, they probably represent a separate volcanic centre. This is a common situation, with many outcrops representing isolated, small volcanic edifices at about the same stratigraphical level within a deep-basinal sequence.

The other feature of interest concerns the metasomatic replacement of basic contact-metamorphic assemblages by the minor development of biotite and diopside. These minerals are representative of two different metasomatic processes seen elsewhere within the Land's End aureole: the K (for biotite) being derived 'externally' from the granite, whereas Ca (for diopside) was derived 'internally' via mobilization of greenstone constituents.

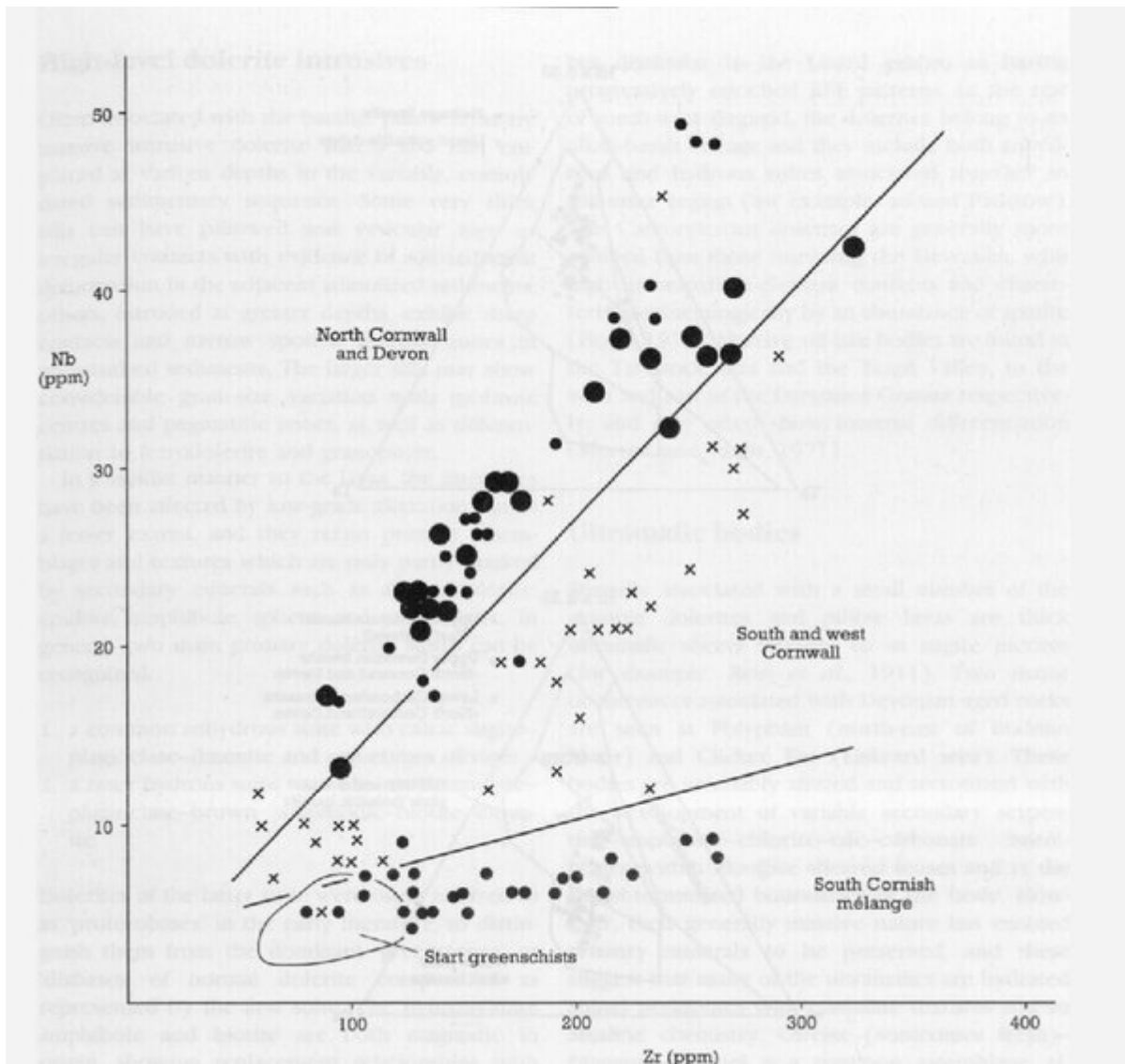
### References



*(Figure 4.15) The two greenstone masses of Gurnard's Head. The intervening hollow is underlain by metasediments. Gurnard's Head, Cornwall. (Photo: P.A. Floyd.)*



(Figure 4.16) Sheared and flattened *L. per* Devonian pillow lavas associated with the massive greenstone body at Gurnard's Head, Cornwall. (Photo: P.A. Floyd.)



*(Figure 4.2) Variation of Zr and Nb in Upper Devonian (small dots and crosses) and Lower Carboniferous (large dots) basaltic lavas relative to different geographical regions. Data largely from Floyd et al. (1983) and unpublished.*