

## MASSIVE SULPHIDE PROSPECTIVITY IN SW ENGLAND

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The British Geological Survey (BGS) has recently re-evaluated the potential for stratiform base-metal sulphide mineralisation in Devon and east Cornwall (Rollin *et al.*, 2001) (Figure 1). On the basis of their stratigraphy and tectonic setting the Lower Carboniferous strata between, and to the north of, Bodmin Moor and Dartmoor are favourable targets for Iberian Pyrite Belt (IPB)-type deposits (Figure 2). Similarly, the geological setting of the Middle to Upper Devonian sediments of Exmoor, north Devon, are comparable with those of the Harz basin in Germany which hosts the major polymetallic Sedex deposits at Rammelsburg and Meggen.

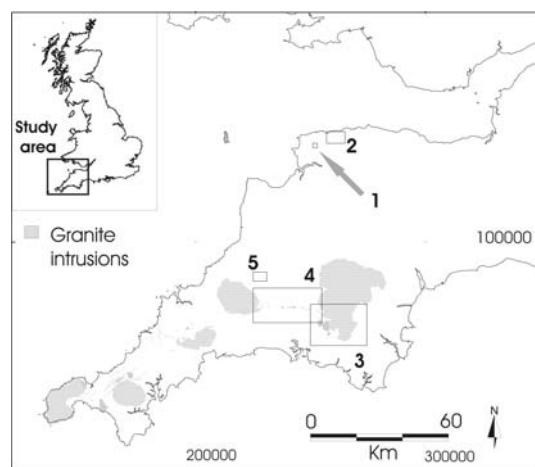


Figure 1. Location of areas investigated. 1. West Down; 2. Combe Martin; 3. Dartmoor; 4. Central region; 5. Egloskerry

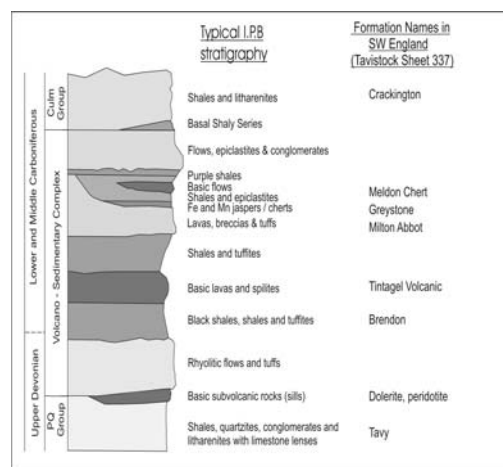


Figure 2. Stratigraphy of IPB compared with the area between Bodmin Moor and Dartmoor, SW England.

A large amount of exploration has been carried out in the target region by commercial companies and BGS, ranging from regional reconnaissance surveys to detailed prospecting. Digital data from these surveys has been used to assess the potential for the occurrence of stratiform sulphide deposits using knowledge-based prospectivity analysis tools including ArcView SDM (Spatial Data Modeller) (Rollin *et al.*, 2001). Prospective targets identified in this study include the area between the Bodmin and Dartmoor granites, parts of Exmoor and east Dartmoor, each of which is discussed below.

The central area between Bodmin Moor and Dartmoor is prospective for IPB-type deposits due to the following features: Lower Carboniferous strata, including many formations with black shale; strong magnetic anomaly; many thrusts; widespread stream-sediment anomalies for Mn and Zn; and the highest concentration of stratiform mineralisation in SW England, including prospects at Egloskerry, Bridestowe and Chillaton.

Other targets for stratiform sulphide mineralisation are present in the Exmoor district. Minor stratiform base-metal occurrences are known at Lester Point, on the coast at Combe Martin, as well as at other localities inland to the south-east, together with drainage geochemical anomalies for Zn, Mn and Pb (Jones *et al.*, 1987). A distinct linear aeromagnetic anomaly trending west-north-west to east-south-east extends for at least 40 km following the boundary between the Ilfracombe Slates and the Morte Slates. Two boreholes, previously drilled to test this anomaly at Honeymead Farm, (Jones *et al.*, 1987), showed that the source was probably pyrrhotite that had been produced by recrystallisation of syngenetic pyrite.

Other targets are found in the east Dartmoor area where Lower Carboniferous strata are overthrust and are associated with minor positive gravity anomalies. High contrast, multi-site Ba anomalies in the Teign Valley may reflect known vein baryte mineralisation, while associated Mn anomalies may be due to Pb-Zn-Cu-As-Ba mineralisation to the east of the River Teign. In the Teign Valley, near Bridport and Bovey Tracey, previous geochemical and geophysical surveys by BGS, followed by drilling at some sites, supported the existence of stratiform mineralisation (Beer *et al.*, 1992).

Additional targets occur in the Lower Carboniferous succession in the central area between Bodmin Moor and Dartmoor granites. Previous commercial exploration at Egloskerry, near Launceston, in the early 1980s, including soil and deep overburden sampling and drilling, identified stratabound galena and minor sphalerite in Lower Carboniferous shales and mudstones of the Liddaton and Crackington Formations. In order to evaluate the utility of high-resolution gravity surveys in exploration for stratiform sulphide mineralisation in this environment BGS carried out a detailed survey over an area of about 20 km<sup>2</sup> (Rollin *et al.*, 2002). The new work identified a positive residual gravity anomaly that showed a strong correlation with geology and also with anomalous Zn and Pb soil geochemistry.

New IP and high-resolution gravity surveys were also carried out over the Combe Martin area and parts of Exmoor. At Combe Martin, where argentiferous galena was mined for several centuries from predominantly vein-style mineralisation, a low-amplitude positive gravity residual anomaly was identified along strike of the former workings, approximately along the outcrop of the Lester Slates which are the main host to the mineralisation. Farther east, the IP survey identified an anomaly near the Honeymead borehole that may be related to pyrrhotite identified in drillcore.

New geophysical investigations, following up targets identified in the prospectivity analysis, have confirmed the potential of these areas for stratiform base-metal sulphide mineralisation. Additional targets highlighted by the prospectivity analysis remain untested. Furthermore, this study indicates that high-resolution gravity and IP techniques have the potential for identifying concealed mineralisation in this region.

## References

- Beer, K. E., Ball, T. K., Cooper, D. C., Evans, A. D., Jones, R. C., Rollin, K. E., and Tombs, J. M. C. (1992) Mineral investigations in the Teign Valley, Devon. Part 2: base metals. *Mineral Reconnaissance Programme Report of the British Geological Survey*, No 123.
- Jones, R. C., Beer, K. E. and Tombs, J. M. C. (1987) Geochemical and geophysical investigations in Exmoor and the Brendon Hills. *Mineral Reconnaissance Programme Report of the British Geological Survey*, No 90.
- Rollin, K. E., Gunn, A. G., Scrivener, R. C. and Shaw, M. H. (2001) Potential for stratiform massive sulphide mineralisation in south-west England. *British Geological Survey Commissioned Report CR/01/240*, DTI Minerals Programme Publication No 9.
- Rollin, K. E., Shaw, M. H., Benham, A. J., and Morgan, D. J. R. (2002) High-resolution gravity surveys at Egloskerry and Combe Martin, SW England. *British Geological Survey, Internal Report*. IR/02/195