

## Abstracts of other papers read at the Annual Conference,

### January 1991

**Zircon and monazite - important mineral phases in the Cornubian batholith.** *Frank Lucas, Camborne School of Mines.*

Zircon and monazite are found in small, but significant quantities in all the exposed parts of the Cornubian batholith. Their importance lies in the fact that Zr, Th and REE are useful indicators during magmatic differentiation and fractionation of the state of evolution of the granite. Their contribution to the whole rock uranium and thorium totals are also of importance, though secondary to that of Uraninite, with regard to heat production and therefore to Hot Dry Rock technology. There are significant differences in the abundance of zircon and monazite in the various plutons and amongst different granite types. These differences are paralleled by variations in the modal biotite content. Both zircon and monazite show evidence of more than one phase of growth and this is believed to reflect restite/magmatic or supercrustal xenolithic/magmatic events.

**The magmatic-hydrothermal transition in the Dartmoor Granite.** *R.C. Scrivener, D.R.F. Derbyshire and T.J. Shepherd, British Geological Survey.*

Field evidence is presented for numerous flat-lying sills and dykes of aplitic composition emplaced in the main-stage granite of central and eastern Dartmoor. Textural evidence implies the separation of a hydrous fluid within these aplite bodies resulting in the growth of pegmatite pods and in alteration of the host main-stage granite. The Rb/Sr, Sm/Nd and rare earth systematics of these rocks are discussed, together with fluid inclusion evidence. It is suggested that the hydrous fluid is the progenitor of cassiterite-tourmaline mineralisation in contemporaneous fracture veins.

**Authigenic copper sulphide mineralisation in Restronguet Creek, Cornwall.** *A.J. Beer, Camborne School of Mines.*

Authigenic copper sulphide mineralisation has been reported by several authors in Restronguet Creek, Cornwall. New data from optical and scanning electron microscopy is presented, together with results from a chemical speciation modelling program. These data demonstrate the zonation of these minerals and also attempt to explain their distribution within the different sedimentary environments of Restronguet Creek.

**The geology of Park and Stannon china clay pits, Bodmin Moor.** *Professor C.M. Bristow, Camborne School of Mines.*

Approximately 200,000 t.p.a. of china clay is currently produced from Park and Stannon china clay pits in the Bodmin Moor granite and is mainly used as a paper filler. Besides these active china clay operations there are at least six other abandoned china clay pits.

The development of the china clay deposits on Bodmin Moor has many parallels with the St Austell area, but there are some differences. The parent Bodmin Moor granite is a biotite granite, which means that a considerable amount of iron has had to be removed to enable white china clays to be formed. There is little tourmaline, and most of the veining seen in the pits is late stage non-tourmaline bearing iron stained quartz veins.

Two types of kaolinisation can be recognised:

'Moor' kaolinisation underlying many of the wide marshy hollows (slads) and forming relatively shallow, poor quality layers of kaolinised granite.

'Deep' kaolinisation, usually found where major lineaments intersect, and involving higher quality clays.

The china clays exploited currently in Stannon and Park china clay pits are mainly from areas of 'deep' kaolinisation, and the sites of the lineaments are seen to be marked by massive non-tourmaline bearing iron stained quartz veins analogous to the Stage IV veins of the St Austell granite. In Park pit dextral movement along a NW-SE vein is seen and may be associated with late-stage movement along an extension of the Portwrinkle wrench fault. It is proposed that the 'deep' kaolinisation is associated with downdrawn meteoric waters on the downward links of radiogenically driven convection cells and is therefore analogous to the St Austell kaolins, whilst the 'moor' kaolinisation has a more significant Tertiary weathering element in its formation.

**Observations on the occurrence, distribution and geochemical pathways of niobium in West Cornwall.** *M.K. Durkin, Department of Earth Sciences, University of Oxford.*

Analytical data are presented for Nb abundances in a variety of Cornish rock types. An opportunity is taken to review the fundamentals of Nb geochemistry, and to show how this may assist in an understanding of Nb substitution into magmatic host phases.

Nb pathways during greenschist metamorphism and hydrothermal alteration of greenstones and granites respectively, are also considered.

**Geochemical exploration in heavily contaminated areas: the experience of the last 20 years in south-west England.** *C.J. Moon, Department of Geology, Leicester University.*

Geochemical exploration in this major mining district has proved problematic as a result of the previous several hundred years of mining and smelting. Waste from mined deposits is spread over the order of km<sup>2</sup> and gives a surface signature several times stronger than an undisturbed deposit.

The aim of this contribution is to synthesize the academic and commercial work of several tens of prospects over the last 20 years, much of the latter information has only recently become available in the public domain.

Classical surface geochemistry, particularly stream sediment sampling, is of little use near significantly mined areas due to contamination from mine waste and discharge from adits. An additional reason for the lack of stream sediment sampling by companies is the availability of data from published regional surveys, notably the Wolfson Atlas. Soil sampling can delineate vein mineralisation but is often ambiguous and can only be resolved by deep augering or trenching. As a result many commercial companies have made deep sampling their primary exploration approach; it also has the advantage of not assuming that the overburden is residual. A detailed example of the problems of regional soil sampling from a 40km<sup>2</sup> area around the producing Wheal Jane mine will be discussed. The major mineralised structure is clearly distinguished but two other major anomalies reflect another possible mineralised elvan and extensive contamination around the village of Chacewater. A comparison of deep sampling and surface results will also be made over the Egloskerry massive sulphide prospect. Rock geochemistry has not been widely applied in S.W. England as the fissure veins have very limited primary concentration haloes and outcrop is poor; however, fractionated and altered granite bodies associated with stockworks can be defined using this method. The example of the Hemerdon tungsten deposit will be used. The deposit is detectable from regional scale sampling of south Dartmoor and is surrounded by a halo of at least 200m width enriched in Sn, W, Mo, Cu, Bi, As, Si and K and depleted in Na and Ca.

Regional geochemical maps emphasise the mined areas at the expense of more subtle responses from other, previously unsuspected, deposit types and mask background lithological signatures. There is also a lack of information for rare and precious metals. The recently discovered gold and massive sulphide prospects in south Devon are an example of this. These gold prospects give rise to discrete panned concentrate gold anomalies but with limited copper and zinc highs. The copper anomalies are easily missed in a high noise background of contamination.

**Sub-Mesozoic stratigraphy and Variscan structure under the Inner Bristol Channel.** *Marios Miliorizos, Department of Geology, University of Wales, P.O. Box 914, Cardiff, CF1 3YE.*

The Bristol Channel conceals major Variscan structures separating the two distinct onshore Palaeozoic terranes of South Wales and North Devon.

Mapping of seismic reflectors from recently acquired data from the Bristol Channel has revealed an ESE-WNW striking thrust with a moderate SSW dip. This previously identified structure, the Bristol Channel Thrust, has been reactivated during the Mesozoic and developed as part of the Bristol Channel Fault Zone. It separates a southerly sub-Mesozoic sequence of indistinct seismic character from a strongly reflective northern sequence. These are postulated to be the Devonian strata and the Carboniferous Limestone respectively. Hence the Bristol Channel Thrust may be interpreted as the main Variscan thrust separating the onshore Palaeozoic terranes.

Further examination of the seismic sections in conjunction with onshore geological mapping along the north Devon coast shows that the Bristol Channel Thrust has an attitude typical of thrusts observed at Foreland Point. However, the displacement along any one such thrust is thought to be insufficient to juxtapose the Devonian strata of North Devon and the South Wales Carboniferous. Hence, other thrusts are inferred under the Bristol Channel to accommodate the excess displacement. In addition, the antiform at Foreland Point suggests the presence of at least one thrust immediately offshore (the North Devon Coastal Thrust).

The Gravel Margin Thrust (previously undescribed) lies in the footwall to the Bristol Channel Thrust and has a similar strike but steeper SSW dip. It extends to anticipated basement depths. The Gravel Margin Thrust, together with the Bristol Channel Thrust, in conjunction with a possible seismically-imaged kilometre-scale thrust in the hangingwall of the Bristol Channel Thrust, are mainly responsible for the arrangement of the Palaeozoic rocks prior to Mesozoic reactivation.

The along-strike structural changes beneath the Inner Bristol Channel indicated on the seismic reflection sections provide evidence additional to earlier refraction studies for the offshore continuation of the NW-SE trending Cothelstone Fault.

**The Porthoustock Shear Zone: oceanic mylonitisation in the Lizard ophiolite.** *Wes Gibbons and Lucy Thompson, Department of Geology, University of Wales, Cardiff.*

Amphibolitic schists exposed on the east coast of the Lizard display strong synmetamorphic mineral lineations and mylonitic shear sense indicators. The protoliths to these schists are mostly ophiolitic gabbros and basic dykes. The schists were generated within an amphibolite facies ductile shear zone that separates the Crousa gabbro/sheeted dyke complex from 'Traboe' - type Moho rocks exposed north of Porthkerris. This Porthoustock Shear Zone is interpreted as a major extensional structure that brings down the higher levels of the ophiolite against the base of the oceanic crust. A consistent 'top to the southwest' sense of shear throughout much of the Porthoustock Shear Zone indicates the deformation does not relate to northward directed obduction. Furthermore, gabbroic pegmatites cutting strongly mylonitised gabbros at the base of the Porthoustock Shear Zone suggest the shearing occurred close to the spreading ridge.

**Occurrence of Bassanite in the Lower Lias rocks of the Lyme Regis area, England.** *Tamrat Worku, Postgraduate Research Institute for Sedimentology, University of Reading.*

Bassanite ( $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ ) has been identified by x-ray diffraction in samples from various horizons of the Lower Lias section west of Charmouth, Dorset: the Blue Lias, the Shales-with-Beef and the Birchi Nodule bed. Occurrences of bassanite in evaporite sequences and in sulphur-rich volcanic environments have previously been reported, but in sedimentary sequences in temperate climates it is extremely rare. In this case it is concluded that the bassanite may have formed by reaction between sulphuric acid, produced by the weathering of pyrite, and calcite.

**The depositional environments of the Upper Greensand at Branscombe, S.E. Devon.** *Colin L. Williams, Department of Geological Sciences, Polytechnic South West.*

The largely complete section through the Foxmould Sands and Chert Beds at Branscombe displays a series of increasingly shallow marine depositional environments. Evidence will be presented to show that the Foxmould Sands are a series of deep water deposits occasionally affected by storm events, while the Chert Beds exhibit features which suggest that both tidal and storm wave/current regimes were instrumental in their deposition.

**Models of drainage evolution in the valley of the lower Lyn, North Devon.** *Neil R. Page, Middlesex Polytechnic.*

Alternative topographic models are presented to account for the evolution of the Valley of Rocks, North Devon. These models are compared with the modern topography. Significant problems emerge in relation to the marine capture hypothesis normally advocated for the Lynmouth-Lynton area. The paper considers the extent to which a West Lyn diversion model offers an improved level of explanation.

**The impact of rising sea level on the social and economic life of Cornwall.** *T.J. Peters and R.P. Edwards, Camborne School of Mines.*

A study of the records from the Newlyn tidal gauge for the last seventy five years has been carried out. Analysis of these data reveals that mean sea level has risen by 13cm since 1915 and that the rate of sea level rise is accelerating.

Two sites of social importance at Truro and Hayle were surveyed and survey data was obtained from Par docks. Our predictions about the height of sea level in 2025 suggest that major civil engineering programmes will have to be undertaken at Truro and Hayle to prevent regular flooding.