

ABSTRACTS OF OTHER PAPERS READ AT THE ANNUAL CONFERENCE, JANUARY 1993



TRACE FOSSILS IN UPPER CARBONIFEROUS SEDIMENTS OF THE CULM BASIN AND THEIR IMPLICATIONS FOR GENERAL DEPOSITIONAL PROCESSES

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The trace fossil assemblages found in the Culm Basin have been divided into three major ichnofacies after Seilacher (1967): the turbidite and deep basin shale facies (Crackington, Westward Ho! and Bude Formations), with *Chondrites sp.* and *Planolites ophthalmoides*, correspond roughly with the *Nereites* ichnofacies; the prodelta, delta front and delta platform facies (Westward Ho! and Bideford Formations), with *Planolites sp.*, *Cochlichnus sp.*, *Teichichnus sp.* and *Lockeia sp.* reflect the *Cruziana* ichnofacies or a mixture of *Cruziana* and *Skolithos* ichnofacies; the delta plain facies and lacustrine facies (Bideford and Bude Formations), with *Arenicolites sp.*, *A. carbonarius*, *Monocraterion sp.*, *Planolites montanus*, and *P. beverleyensis*, correspond well with the *Scoyenia* ichnofacies.

Additionally omission surfaces are represented by horizons densely colonised by either *Arenicolites*, or *Teichichnus*, or *Planolites*. Successions of escape burrows produced by *Lockeia* have been interpreted as an indicator of seasonal controlled sedimentation in the Culm Basin.

TRANSGRESSION, HYPOXIA AND DEVONIAN EXTINCTIONS

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A number of short-term extinction events, followed by evolutionary radiations, have been documented in the Devonian. The more significant of these have been named the Zlichov, Daleje, Kacak, Taghanic, Frasnian, Kellwasser, Annulata and Hangenberg Events. Comments are made on the factual evidence for extinctions and the sedimentary perturbations which are associated with them. These suggest an interpretation linked with transgression of hypoxic waters across shallow continental shelves. The palaeogeography of the period, with Gondwanaland commencing to dock against Laurussia, would give constrained oceanic and continental basins with poor circulation, which could provide the source of anoxic waters, whose occasional spread across shelf areas could lead to extinctions. These events are short-lived and are often associated with succeeding or preceding regressions. Climatic, eustatic, tectonic and other primary causes for sea level change are considered.

AN INVESTIGATION OF MINERALISING FLUIDS FROM THE DARTMOOR GRANITE

M. F. Miller, R. C. Scrivener and D. Banks, BGS Keyworth, BGS Exeter and University of Leeds

Mineral veins in the Dartmoor Granite typically comprise assemblages of tourmaline, cassiterite, haematite and quartz. Individual deposits are distributed in a pattern that indicate large-

scale zoning within the pluton. This contribution reports the fluid inclusion anion, cation and stable isotope chemistry for the various stages of mineralization at a variety of localities in the central and north-eastern part of the pluton. Techniques used include $\delta^2\text{H}$ and $\delta^{18}\text{O}$ measurements, together with recently developed advances in the analysis of fluid inclusion electrolytes. The results of this study indicate the significant extent to which fluids of magmatic origin were involved, from early tourmaline-cassiterite to late-stage quartz-haematite mineralisation.

THE BORON ISOTOPE GEOCHEMISTRY OF CORNUBIAN GRANITES

M. R. Palmer and D. London, University of Bristol and University of Oklahoma, USA

One of the most striking aspects of the Cornubian granites is the extensive associated boron mineralization of the country rocks and the granites themselves. Various theories have been proposed for the source of the boron, with some suggestions including the melting of boron-rich sediments in the source region of the granites and stoping and assimilation of boron-rich country rocks during emplacement of the granites. In an effort to address the overall problem of the source of the boron and its involvement in the evolution of the granites and associated ore bodies, we are undertaking a detailed study of the boron isotope systematics of the area. As an initial project we have measured the boron isotope composition ($\delta^{11}\text{B}$) of tourmalines from granites, hydrothermal veins, pegmatites and metasomatized country rocks from throughout the region. The $\delta^{11}\text{B}$ values of the tourmalines range from -12.8 to 5.0% (average precision = ± 0.3). Previous studies have shown that the boron isotope composition of tourmalines is controlled by the source of the boron, the formation temperature of the tourmaline and the boron isotope evolution of the fluids/melts that precipitate the tourmaline. Preliminary analysis of the boron isotope data from the granites of Cornwall and Devon suggests that the source of boron was not homogeneous, with granites from the Dartmoor area being characterised by relatively higher $\delta^{11}\text{B}$ values than those from further west.

WOOLLADON BALL CLAY PIT, NORTH DEVON - FURTHER DEVELOPMENTS IN 1992 AND THOUGHTS ABOUT THE FORMATION OF THE BALL CLAY BASINS IN NORTH AND SOUTH DEVON

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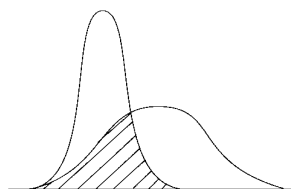
Further development in 1992 of Woolladon ball clay pit in the southwestern part of the Petrockstow basin has provided superb sections through the thrust fault zone which forms the western boundary of the basin. The main thrust is seen to be riding forward over a carpet of debris shed from the forming fault scarp. The lower limit of this debris is irregular, reflecting the fact that it was

being pushed down into very plastic sediments underneath. Exposures through the weathering profile developed on the Culm shales and sandstones immediately below the Palaeogene sediments show the pallid and mottled zones with some iron enrichment immediately underlying the old land surface. An unconformity can be demonstrated between the older, main ball clay sequence and a younger sequence of mottled clays. The red colours of the younger sequence suggest a less mature material from a weathering point of view; supporting the notion that the main ball clay sequence was laid down before thrust movement started, and the red mottled clays were laid down after movement had started.

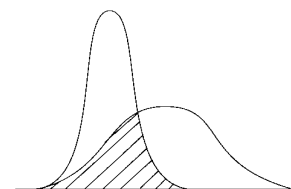
One possible explanation for the thrust margins of the Petrockstow Basin would involve two phases of movement. The first phase would have taken place during the east-west extensional

regime in the early Tertiary, corresponding to the initiation of fast spreading in the Atlantic and the Palaeogene volcanic activity on the western side of the British Isles. Most of the sediments in the basin date from this first extensional phase. The second phase would correspond with the north-south compressional regime developed in mid-Tertiary times, corresponding with the Alpine orogeny. This caused compression across the basin and the development of the thrust faults on either side. Shortly afterwards sedimentation in the basin ceased.

Most of the dextral movement on the north-west—south-east strike-slip faults of the Cornubian massif is now thought to be immediately prior to the intrusion of the granites, which 'locked up' the strike-slip faults, so that the Tertiary basins formed to the north and south of the batholith, mainly as a result of vertical movements.



Risk Assessment in the Extractive Industries



22nd-24th March 1994 • University of Exeter

The Conference

The aim of the conference is to increase awareness of the benefits of risk assessment applied to most aspects of the extractive industries.

Risk assessment is applied at varying levels of sophistication within the extractive industries but in general is not widely used. The benefits can include a more realistic approach to the uncertainty of the financial, technical, legal and social aspects of projects and better communication between the different interest groups.

We are seeking contributions from a wide range of disciplines within or loosely related to mining, minerals and energy exploitation. The understanding and communication of various perceptions of risk, uncertainty and probabilistic analysis will be an important unifying theme.

The conference will be held and accommodation provided at the attractive campus of the University of Exeter, with which the Camborne School of Mines will link during 1993.

The Participants

Engineers, geologists, regulators, financiers, environmental scientists, academics and students associated with the mining, quarrying, waste disposal and tunnelling industries.

The Scope

Methods and applications of risk assessment in:

resource estimation • site investigation • excavation stability (surface and underground).
waste disposal and land rehabilitation/reclamation • mineral processing • energy extraction
(oil, gas, geothermal) • financial and project appraisal • social, environmental and legal aspects

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