

**ABSTRACTS OF OTHER PAPERS/POSTERS PRESENTED AT THE  
ANNUAL CONFERENCE, JANUARY 2006**



**SCOTT SIMPSON LECTURE**

**VARISCAN OROGENY AND THE  
UNITED PLATES OF EUROPE**

Wolfgang Franke

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The Variscan orogen forms the continental basement of Europe, from Wales to Morocco, and from Portugal to Poland. It is a tectonic collage of major continents (Laurentia, Baltica, Gondwana) and intervening microplates (Avalonia and the Armorican archipelago). Plate convergence occurred between c. 420 and 300 Ma, and oceanic basins (or seaways) were closed by c. 340 Ma (Late Tournaisian). Collisional shortening amounts to  $\geq 1000$  km.

Variscan orogeny was "hot": thick clastic sequences and several generations of plutonic rocks provided heating by isotopic decay of K, U and Th. Deeply subducted rocks were heated by contact with the mantle. Subsequent obduction of hot metamorphic rocks in closely spaced sutures, as well as numerous granite intrusions, transferred heat to upper crustal levels, welding together the tectonic edifice. Hot, low-viscosity granulites were even able to intrude into the crust of the Saxo-Thuringian foreland basin.

Correlation of the Variscan externalides of S-Portugal, SW-England, Rhenish Massif, Harz Mts. and Moravia provides a backbone of the structural pattern, which is supported by numerous common features. Closer inspection reveals disruption by strike-slip faults across and along the tectonic trend. There is something wrong in SW England ...

**SALTASH.NET COMMUNITY SCHOOL –  
THE EARTH SCIENCE CENTRE**

Gordon Neighbour

*The Earth Science Centre, saltash.net community school,  
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The saltash.net community school Earth Science Centre is in the process of being set up. The school has been successful in gaining funding from English Nature through the Aggregate Levy Sustainability Fund. The project is being run in conjunction with partners in higher education and from within the earth science industry. Differing from many schools, what is being offered from the Earth Science Centre is support for earth science education in the south east Cornwall "Caradon Network Learning Community", which is allowing saltash.net community school to support teaching and learning in earth sciences across the full spectrum from key stage 1 to key stage 5. The first phase of the project is now underway with the development of a set of teaching resources that will be available for partner schools, the initial ground-works being put in place for the main Earth Science Centre building and the development of a "sensory pathway" to allow safe and secure access to geology for disabled students.

**MID-LATE HOLOCENE CHANNEL  
CHANGE OF THE EXE RIVER:  
STABILITY, MIGRATION AND AVULSION**

J.A. Bennett and A.G. Brown

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New dating using both radiocarbon and optically stimulated luminescence has extended our knowledge of channel change at five sites along the River Exe in Devon. This data has been combined with historical records and studies undertaken in the 1970s. This shows that the decadal changes revealed by historical data tend to be migration (particularly meander extension), chute cutoffs and stability. Stability is as would be expected most common in confined reaches but also in small braided or subdivided reaches with main channel oscillation side to side of a bar or island. The longer term records from the OSL and radiocarbon dates reveal avulsion including the re-occupation of former channels. These channels represent the channels last position prior to avulsion. If we assume that a similar decadal pattern also existed for these channels than a model of floodplain formation can be postulated. In this model channels migrate and oscillate about a sinuous planform sometimes drifting in a preferred local direction until avulsion occurs due to a major event and/or the instability of levees. The reoccupation of former channels will allow such lateral deposits to be stacked and is part of floodplain aggradation by overbank and bed sedimentation. A recent attempt by the Exe to avulse into a former channel in 2000 reveals the both the instability in the system and its medium-long term semi-predictability. This channel behaviour and floodplain formation has major implications for fixed structures on floodplains.

**PROTECTING AND PRESENTING THE  
JURASSIC COAST**

Richard Edmonds and Chris Pamplin

*World Heritage Team, C/O Dorset County Council,  
County Hall, Dorchester, DT1 1XJ, U.K.*

A summary of the Dorset and East Devon Coast World Heritage Site, how it qualified for World Heritage Status and how the World Heritage Steering Group, Dorset and Devon County Councils, English Nature and many other partners are working to conserve, manage and present the site as a world class venue for the earth sciences is presented. The poster will focus on the challenges and achievements in relation to science and conservation and the growing work programme on education, interpretation, arts, transport, community development and sustainable tourism.

## THE REMAINING RESERVES OF LIBYA — IMPLICATIONS FOR OPEC OUTPUT

D.D. Clark Lowes

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- Libyan reserves are actually about half the reserves reported by the OPEC secretariat and the BP Statistical Review
- The reserves remaining in the eleven billion-barrel oil fields of the Sirt Basin may still be paramount despite historical production
- Significance of Libya's remaining reserves is discussed in a worldwide context
- Future production estimates are more useful than reserve estimates
- Yet to find oil reserves are probably very much less than widely reported

The emphasis of this talk is on remaining oil reserves rather than 'yet to find' reserves, although the 'yet to find' category will be discussed. The subject of gas reserves will have to wait for another talk. These remaining reserves are the P50, 'Proven plus Probable' or 'Most Likely' originally recoverable reserves estimates, as subsequently revised, less production to date. These are the numbers generally used by energy consultants and politicians when looking at future world energy supply potential. This is a progress report.

The largest category of remaining reserves in Libya is the reserves in the eleven billion-barrel oil fields of the Sirt Basin. This is despite extensive production from these fields over a period of at least 40 years in most cases. These fields contain 9.7 Bbbls remaining recoverable oil reserves. Despite the low level of production to date from the vast number of 'smaller' fields of the country, these more recently discovered fields nevertheless represent a significantly smaller reserve category (6.5 Bbbls remaining). Hence, historically, not only were the biggest oil fields found first but subsequent exploration in the province has failed to replace the produced reserves. This makes a realistic assessment of the likely future performance of the eleven billion-barrel oil fields of the Sirt Basin vitally important, for it seems that this, rather than further exploration, is likely to be the main key to predicting future Libyan production. Ongoing work is geared to establishing in greater detail the truth or otherwise of this assertion.

The significance of Libya's remaining reserves is discussed in a worldwide context and caution is counselled in using the remaining reserves figures of the Arabian OPEC countries. It is argued that to focus on future production estimates is a better way of obtaining a feel for future supply than focussing on reserve estimates. Although, of course, the two approaches are related, the focus on production potential forces consideration of likely production profiles and therefore the apportionment of production over time, something missing from the simple focus on reserves.

## BIDDIBLACK AND ITS GEOLOGICAL SETTING

N.E. Butcher

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Recollections of a visit to the then working mine at East-the-Water, Bideford on 21 September 1963 which produced the marketed pigment Biddiblack from beds of culm in the Carboniferous strata of North Devon. These will be made with regard to some of the personalities involved in understanding the geology of North Devon.

## THE CULM SEAMS OF NORTH DEVON

James Coulter

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The greater part of central and west Devon is covered by the Carboniferous series known as the Culm Measures. Within this area, culm, a form of anthracite, occurs in scattered deposits which may have been individually worked for centuries as fuel for smelting or other purposes. In more recent times, the only seams thick enough to have supported commercial exploitation occur on a line running approximately west/east for a distance of about 15 km from Greycliff, near Abbotsham to a point east of the River Taw. The seams worked for fuel produced a hard lumpy material with a carbon content of around ninety percent which by the turn of the nineteenth century were largely worked out. Associated with these, were seams of a quite different material having a stiff paste-like consistency containing almost equal parts of carbon, alumina and silica. This was mineral black—the so-called Bideford Black which became the base material for a thriving local paint industry and which continued to be worked into the first half of the twentieth century.

## MINERALIZATION IN THE MID TRIASSIC

G. Warrington

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North-south 'cross course' veins in the Variscan basement in SW England yielded mean Rb-Sr and Sm-Nd isochron dates that indicate a Mid Triassic age. They formed from low temperature, high salinity fluids that are thought to have been expelled from nearby sedimentary basins. These occurrences are remote from post-Variscan sedimentary deposits and an origin from basinal brines in Mid Triassic times has palaeogeographic implications, indicating that formations as young as the Otter Sandstone, capped by the Sidmouth Mudstone, formerly covered parts of the now exposed Variscan basement, forming conduits for basinal brines. Permian and Triassic formations host low-temperature mineralization in the region but its original extent is unknown. Potential analogues occur in the Cheshire Basin. At Alderley Edge, low-temperature mineralization dominated by Cu, but including Pb, As, Co, Mn, Ni, V and Ba, occurs in c. 100 m of fluvial and aeolian deposits, mainly in the Mid Triassic Helsby Sandstone Formation. This occurrence, in a N-S horst structure, is uniquely accessible in extensive mine workings, large parts of which are attributable to the activity, between 1857 and 1877, of a company created and managed by Cornishmen.

## THE WEST DORSET FOSSIL COLLECTING CODE OF CONDUCT

Richard Edmonds and Chris Pamplin

*World Heritage Team, C/O Dorset County Council,  
County Hall, Dorchester, DT1 1XJ, U.K.*

The West Dorset code has been in operation for six years and the poster will summarise how the code was established, what it has achieved to date and the priorities for future management. The code has also been set in context within a paper that develops a site based approach to the management of palaeontological interest, which is currently a consultation document. The poster will invite contributions from the Ussher Society to this initiative.

**HYDROCARBON EXPLORATION  
WITHIN THE DORSET AREA –  
DO ANY SIGNIFICANT COMMERCIAL  
DISCOVERIES REMAIN?**

M.L. England<sup>1</sup>, P. Farrimond<sup>2</sup>, A. Hindle<sup>3</sup>,  
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The exploration for hydrocarbons and their precursors within the county of Dorset has a long history, going back as far as the Iron Age, when the oil shales of the Kimmeridge Clay were used as fuel. The first oil impregnations within the Wessex Basin were discovered by geologists, of the then D'Arcy Exploration Company, during surveys in the 1930s. Exploration by D'Arcy began in 1938 and was later continued by the BP/GC(E) Group. Exploration within the region is currently being carried out by Egdon Resources Plc. Currently three fields within the Wessex Basin are in production, these being Wytch Farm, Wareham and Kimmeridge, all of which are operated by BP. The Wytch Farm oilfield contains the majority of the oil reserves discovered to date within the Wessex Basin with original reserves estimated at 450 million barrels.

The reservoir hydrocarbons within the Wessex Basin are sourced from the organic-rich shales and mudstones of the Lower Lias, and the source kitchen (as projected by Egdon Resources) is believed to lie in the offshore region to the south of Purbeck. Migration models have been proposed by Egdon Resources based on fluid flow mechanics and pore entry pressures in order to aid exploration efforts.

The majority of the reserve potential within Egdon's Wessex Basin licences lies in the Sherwood Sandstone reservoir. Egdon currently has a portfolio consisting of a total of 15 prospects within the Dorset area. One of these prospects (Waddock Cross) was recently drilled in 2004, and oil was flowed at a rate of 31 barrels per day from a 24 m oil column in the Bridport Sands reservoir; horizontal drilling of this prospect has just begun (late 2005) in order to attempt to realise commercial production rates. Plans are also in place to drill further exploration wells within the region to test proposed migration pathways.

**A CASE STUDY IN  
COASTAL EROSION AND MANAGEMENT;  
WESTWARD HO! AND NORTHAM BURROWS**

Peter Keene

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Abingdon, Oxon, OX13 5AD, U.K.*

The development of the Victorian resort of Westward Ho! is plotted against the history of continuous coastal change. Responses to the threat of coastal erosion are reviewed with the emphasis upon changing perceptions of the problem and the appropriate strategies of coastal management. Current policies are considered in the light of rising sea levels and 'greenhouse threats' to the low-lying area of Northam Burrows.

**MINERALS, MOULD AND MINING:  
GEOLOGICAL CONSERVATION AT THE  
ROYAL CORNWALL MUSEUM**

Jodie Fisher and Sara Chambers

*Royal Cornwall Museum,  
River Street, Truro, Cornwall, TR1 2SJ, U.K.*

The mineral collection of the Royal Institution of Cornwall is internationally significant both historically and scientifically. The collection contains the 18th century mineral collection of Phillip Rashleigh. With the accompanying documentation and correspondence, the collection illustrates the development of Cornish mining and the science of mineralogy. The collections of many other eminent local collectors are also represented, with rare and spectacular specimens from the mines of Cornwall and Devon. Many of these specimens come from mines and areas that are no longer accessible, so it is vital that they are preserved for current and future reference and research purposes.

Work is being undertaken to conserve the mineral collection at the Royal Cornwall Museum, using both preventative and interventive methods. All specimens are being cleaned to remove the acidic or alkaline products, which are unsightly and may cause damage. Support and packaging for specimens susceptible to abrasion damage is also being provided. Microenvironment provision is particularly useful for specimens susceptible to pyrite decay or other relative humidity (RH) related phase transitions. These specimens are cleaned, or treated to neutralise the decay products, and placed in anoxic or conditioned environments to prevent any further degradation of the specimen. Specimens susceptible to light induced colour change and decomposition are also assessed and placed in suitable darkened conditions. This major conservation programme will enable enhanced access to the specimens and ultimately help promote the understanding and appreciation of the unique geology and mineralogy of the southwest.

**GILLAN CREEK, SOUTH CORNWALL –  
ANATOMY OF A SMALL RIA**

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Gillan Creek is a small *bay-like* ria, 2 km long landward of the mouth of the larger macro-tidal Helford ria, to which it was once a tributary. The distribution of shore platforms and Mid-Late Pleistocene deposits in this outer area indicate that the confluence of the two rivers had been drowned before their formation.

The marine sector of Gillan Creek itself is separated from the inner inter-tidal zone by paired spits with ebb channels separated by a swash bar seawards and an interpreted flood tidal delta, immediately landwards, here making this ria unique. The closest analogue is the L'Auberlac'h ria in Brittany. The flood delta with pronounced ramp, mega-ripples, and ebb shield, is apparently inactive, being surfaced by pebbles and locally seaweed. Ebb spit activity, is however, current.

The present ria formed as result of Flandrian flooding/fluvial erosion of loessic head covered slopes. The presence of well-developed head aprons immediately upstream suggests that in previous interglacials the ria may have extended farther landwards.

The deeply incised fluvial valleys draining into Gillan Creek have their headwaters immediately north of the elevated Lizard Complex to the south, and clearly post-date the Tertiary or older granite-derived Crousa Gravels there.

**POLAR CLIMATE PROXIES:  
DO THEY CUT ANY ICE?**

Steven Rowland, Simon Belt, Guillaume Masse  
and Michel Poulin

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The polar ice caps are very important for the regulation of the Earth's climate and scientists are keen to use records of changes in the past extent of sea-ice to improve their predictions of future climate change. Although we know how the polar ice caps have changed in the last 30 years because we have satellite records, before that time we have to rely on historical records and even these do not allow us to go back much further than 100 years. To go back hundreds or even thousands of years we need to use so-called 'proxies'; things preserved in polar sediments which record where the ice fronts were in the past. Unfortunately there are not too many things that are useful but we have discovered a new one. Preserved in sediments from the Arctic is a unique chemical fossil which originated from microscopic algae which once grew underneath the sea-ice. When the ice melted or the algae died, the chemical was preserved. So by analysing dated sediments (dated by radiocarbon measurements) for the presence of the chemical fossil, which we call H23 (not H2O!) we can determine whether sea-ice was present at a given location in the past. We have done this in sediments dating back to 9000 years.

**CLIMATE CHANGE, SPECTRAL TRENDS  
AND UPPER CARBONIFEROUS STRATIGRAPHY,  
SOUTHERN NORTH SEA**

David Smith

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The thick coal-bearing Westphalian beds of the Southern North Sea (SNS) provide the source for most of the province's natural gas reserves. Separated from the major reservoir sands of the Late Permian Rotliegend Group by the Variscan unconformity, the Upper Carboniferous also includes significant reservoir sands. Detailed correlation of these sands is essential for mapping the subcrop traps beneath the unconformity, but is hampered by poor seismic reflectivity and indifferent biostratigraphic resolution. Conventional lithostratigraphic interpretation of wireline log data is also unsatisfactory, because of the rather featureless and repetitive nature of the strata. An alternative approach is to use the spectral properties of the well logs, i.e. their wavelength, amplitude and phase. A curve representing downhole trends in these properties can be constructed, revealing previously unseen characteristics of the data. The spectral trends, and particularly their turning points, are clearly correlatable between wells and provide the basis for a new subdivision of the Westphalian into eight major units and 35 higher-order units. These units are believed to be genetic (and hence time-significant) through their link with climatic change at Milankovitch timescales ( $10^4 - 10^5$  years). The Westphalian climate in the SNS is predicted to have oscillated between humid and dry. Base-level (and hence accommodation space), sediment supply, and depositional environments would all have been affected, resulting in a stratigraphic succession that forms a record of the changing climate. Hence, correlative trends and turning points in the spectral trend curves from different wells are likely to represent the same time intervals and events, justifying their use as the basis for a robust stratigraphic scheme.

**THE GEOVALUE PROJECT:  
TESTING THE GEODIVERSITY PROFILE IN  
CORNWALL, DEVON AND SOMERSET**

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GeoValue addresses the needs of the community who make field visits to observe geological and geomorphological features as part of professional, educational or cultural activities. Firstly, it has developed the "Geodiversity Profile" as an objective method for assessing quality at geological sites, especially quarries. The purpose of the profile is to enable the community (i.e. landowners, quarrying operators, planning authorities, geological groups, researchers, educators, conservation bodies and others) to distinguish between the qualities of geodiversity in different sites of the same geological setting in the same area as an aid to decision-making. A second part of GeoValue will develop solutions to enable community access to sites of high geodiversity value without compromising the responsibility of the quarry operator to extract minerals efficiently, profitably, and safely.

The Geodiversity Profile involves an audit, called the "Geodiversity Measure". This recognises the presence, and records some detail of, the geological interest categories at the site (e.g. sedimentary rocks, igneous rocks, metamorphic rocks, structural/tectonic features, palaeontology/palaeoecology, minerals/mineralisation, stratigraphical relations, geomorphology). The Geodiversity Measure is followed by an assessment of the "Geodiversity Value". A desk study of geological literature on the site and its surrounding area is a necessary pre-requisite for this stage. The Geodiversity Value is assessed in terms of the scientific, educational, and historical, cultural and aesthetic importance, along with establishing any actual or potential links with the biodiversity at the site. The scientific importance is divided into stratigraphic (litho/bio/chronostratigraphic) importance, geological history/process importance and applied geology importance. These value parameters are determined mainly on the basis of comparison with other sites with a similar geological setting in the same area. Both pure and applied geology are considered for the educational importance along with geological variety and extent of potential hands-on examination. Historical, cultural and aesthetic importance are considered together. The components of the Geodiversity Value are individually scored and can be summed, although the total may not always reflect the high importance of some sites for individual geodiversity features.

The Geodiversity Profile has been tested at sites in Cornwall, Devon and Somerset with a variety of geological settings concentrating on active quarries. Its use provides a way of distinguishing between sites with a similar geological setting. Examples of quarries in the Plymouth Limestone, Bude Formation in North Devon, dolerite in the Upper Teign Valley, and Ham Hill Stone in Somerset illustrate the importance of these as sites for examining geodiversity. Coastal exposures of the Budleigh Salterton Pebble Bed in East Devon, those on the Lizard, and dolerites with mineralisation near Newlyn, Cornwall, show equal or even more geodiversity features compared with quarries of the same geological setting.

**REGIONAL RADON DISTRIBUTION  
AS A GUIDE TO URANIUM MINERALISATION  
IN SW ENGLAND**

C.J. Moon

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Radon is known to pose significant hazards to human health and many countries now have extensive databases based on monitoring houses. In England and Wales over 400,000 houses have been measured by the Health Protection Agency and results released to the public domain in the form of generalised maps and tables. Although there is considerable variation between individual houses the maps clearly reflect geology and therefore original uranium distribution. Results which indicate the radon status of individual houses are not available due to their impact on house prices.

The pattern can be examined at two levels: (1) background variation in which the uranium content at low ppm levels rocks can be estimated and (2) high risk areas which may relate to significantly mineralised units which in England and Wales are restricted to areas underlain and around Variscan granites of SW England and their spatially associated Permian sediments. Background enrichments mainly highlight marine shales and ironstones of Carboniferous and Jurassic age, as well as unmetamorphosed Devonian rocks in SW England.

In SW England higher resolution data are available at 1 km and electoral ward levels. Radon distribution maps at 1 km pixels indicate that in general the granites are coherently high with the exception of the highly kaolinised parts of the more variable St. Austell Granite and the southern part of the Dartmoor Granite. Previous studies show that uranium occurrences are (1) associated with early stage mineralisation mainly spatially connected with hydrothermal copper sulphides and (2) much later cross course (fault related) Fe-Co-Ni-Bi mineralization. The St. Austell granite has been considered to be the best mineralised of the granites and the radon data confirm suggestions that uranium is likely to have been removed from the granite and moved into structures surrounding the granite, where potentially economic accumulations may form. The more coherent radon anomalies of the other granites suggest that uranium is more dispersed and less likely to be concentrated in late structures. The high radon in S Devon can be attributed to enrichment in Permo-Triassic sediments as a result of the decay of uranium moved along the basal unconformity.

**GEOLOGICAL FIELDWORK  
AT THE TURN OF THE 20TH CENTURY:  
THE PHOTOGRAPH ALBUM OF  
HOWARD FOX**

R.C. Scrivener

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Howard Fox's photograph album came to light during the recent re-location of the collections of the Royal Geological Society of Cornwall. It comprises some fascinating views of the geology of west Cornwall, together with some hitherto unknown images of geological fieldwork, two of which include images of W.A.E. Ussher.

**BRIGHT BOVEY BOREHOLE BLAZE  
CASTS NEW LIGHT ON OLD PROBLEM**

Alan Cattell

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Recent site investigation boreholes have penetrated the alluvium of the Teign in northern Newton Abbot. The boreholes proved the main ball clay sequences of the Bovey Formation, the Abbok Member and lignite-bearing Southacre Member, striking southwards under Newton Abbot towards the Torbay Fault, as originally shown by Scott in 1929, and suggested by the author in 1996. They also showed that the eastern end of the southern margin of the Bovey Basin is not faulted. Bovey Formation clays, with a marginal/basal facies containing beds of slate gravel, rest directly on Devonian Slates north of Knowles Hill. An updated map is presented, based on this new information.

The distribution of lignite is not solely of academic interest. Boreholes penetrating through the alluvium found pockets of methane trapped in the alluvial gravels capped by alluvial silts and clays, above the subcrop of the Southacre Member lignites. Gas flows into the boreholes were rapid but short-lived, suggesting perhaps very slow generation but efficient entrapment. It seems probable that the gas is coal-bed methane derived from the underlying lignites.

**PARISH GEODIVERSITY AUDITS IN DEVON:  
RAISING AWARENESS  
OF LOCAL GEO-DISTINCTIVENESS  
IN THE COMMUNITY**

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As part of the Devon Aggregates and Biodiversity Project - a partnership between Aggregate Industries UK and Devon County Council, funded by the Aggregates Levy Sustainability Fund - geodiversity audits of up to 10 parishes are being compiled.

The aims of the project are to develop the objectives of the Devon Biodiversity Action Plan (2005) within and around quarry sites operated by Aggregate Industries in Devon. The Parish Geodiversity Audit Project specifically aims to:

- Document the geological heritage of the parishes surrounding selected Aggregate's Industry quarry sites.
- Establish the geodiversity context of the working quarry site within the broader Parish (building on the *Geodiversity Audit of Active Aggregate Quarries in Devon*, 2003).
- Relate this interest to the wider geological context of the County of Devon
- Identify opportunities for geological conservation, education and interpretation, with an emphasis on the role that local communities might play.

The approach developed to meet these aim, includes elements of geological and landscape survey, the former using Countryside Council for Wales *LANDMAP* methodology for *Geological Landscape* - part of an innovative, holistic approach to landscape description. Examples of completed audits will be demonstrated, including surveys of Bishop's Tawton and Landkey, both near Barnstaple.

**SEDIMENTARY FACIES CHANGES  
ACROSS THE MARINE-FLUVIAL BOUNDARY —  
A NEW HOLOCENE RECORD  
FROM THE RIVER TAW VALLEY,  
DEVON, ENGLAND**

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The transitional zone that links the river catchment and estuary/coastal shelf is an important depocentre and sedimentary sink, containing a relatively uninterrupted record of Holocene sedimentation and environmental change. This zone is a peritidal environment that includes both the upper intertidal-supratidal zones and importantly the area above HAT that is influenced by tidal backwater effects and a high groundwater table. Sedimentation in this area is also likely to be sensitive to changes in relative sea-level over a considerable distance. Despite this, the riverine peritidal zone has received remarkably little geomorphological attention.

New high resolution stratigraphic data from the lower River Taw valley in north Devon has revealed distinct facies correlations across the marine-fluvial boundary. Sediment properties, including magnetic susceptibility, grain size, organic matter and carbonate content, have been used to correlate 10 cores located on either side of the present day tidal limit. Peat formation in the upper Taw Estuary and near HAT is seen to be linked to the contemporaneous minerogenic deposition of organic clays in the lower fluvial system. Silty clay accretion in the estuary is also directly correlated with fluvial sandy silt deposition further upstream. These facies associations are shown to have significant lateral persistence, with correlation being possible between most cores.

The estuarine sequence of intercalated peats and silts is correlated with other coastal sequences in southern Britain (Westward Ho!, the Severn and Thames estuaries and Southampton Water). This has enabled a provisional dating framework for events in the Taw stratigraphy and a speculative model for estuary evolution.

A major early-mid Holocene transgression is evident in the lower part of most cores in the form of a suite of estuarine facies that extend far up the valley and merge into possible freshwater tidal backwater deposits. The transgression is marked by a basal peat followed by deposition of carbonate-rich sand and tidal silt. Increased fluvial activity follows in the middle Holocene, with the widespread deposition of channel sands and gravel, probably related to higher precipitation and runoff levels in the catchment. There then follows a period of channel instability and avulsion in the lower Taw valley, as shown by widespread channel abandonment facies in the middle section of most cores.

It is concluded that the spatial and temporal distribution of facies in the lower fluvial and upper estuarine system is primarily influenced by Holocene sea level change and to a lesser extent catchment hydrology.

**THE DEVELOPMENT OF CROW POINT,  
TAW-TORRIDGE ESTUARY,  
NORTH DEVON**

Deryck Laming

*Ground Floor, 'The Elms',  
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Crow Point is a recurved spit within a macrotidal regime on the north bank of the Taw Estuary at its confluence with the Torridge. Growth of the spit results from tidal currents, moderate wave action and wind accretion which effectively create a sediment convergence zone. Historically it has grown from a small accumulation in about 1847 to a larger feature in the 1950s, despite extraction of large amounts of sand and gravel during that period, with modest growth to the present day. Extraction has now ceased.

Sequential surveys since 1979 have plotted the development of the spit, with growth predominantly at the upstream tip where dune vegetation has become established in the last decade. The neck of the spit thinned, and suffered a storm breach in 1984; another breach was reported from 1921.

Action by waves and flood-tidal currents moves sand eastwards towards and round the point, and ebb-tidal currents from upstream build up the nose of the point with gravel. These are the main contributors to growth, though wind-blown sand from seaward also accumulates above high water mark. Sediment carried by ebb-tidal currents contributes to shoaling at the estuary mouth, where a sub-tidal delta has developed with an average annual accretion of about 500,000 m<sup>3</sup>.