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Conference Reports

International Conference on Iberian Terranes and their Regional Correlation

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The International Conference on Iberian Terranes and their Regional Correlation was organized under the auspices of IGCP Project 233 "Terranes in the Circum-Atlantic Paleozoic Orogens" and was held in Oviedo, Spain, 1-6 September 1986.

The conference started with a day of introduction to the various aspects of terrane analysis. This began with a review of the basic principles of terrane analysis with R.D. Dallmeyer graphically illustrating terrane accretion with photographs of his bathtub toys as the water drains out of the tub — he certainly pulled the plug on this topic! B. Bluck then outlined how terranes may be identified by (i) mismatches in uplift and subsidence histories of adjacent areas; (ii) provenance differences; and (iii) mismatches in the drainage and source areas. He also documented how the nature of terrane amalgamation produces different stratigraphic records: thus thrusting produces coarsening upward sequences, progradation of coarse over fine sediments and roll-up uncomformities while strike-slip amalgamation produces upward-fining sequences and variably oriented overlap sequences. D.L. Bruton showed the necessity of establishing whether faunal province boundaries relate to depth or climatic factors before using them to establish terrane boundaries. Thus, a deep-shallow water faunal province boundary probably does not coincide with a terrane boundary and will migrate up and down the continental margin during transgressions and regressions. On the other hand, different shallow water faunal provinces probably distinguish different terranes. J.D. Keppie after intimating that in orogenic belts, pre-accretionary structures are usually obscured by accretionary structures, proceeded to divide the latter into three categories only some of which may be terrane boundaries: (i) the main "accretionary" thrusts and associated structures; (ii) large transcurrent "dispersive" faults, shear zones and associated structures; and (iii) listric, normal "rift" faults often located along earlier thrusts. The diachronism, up to 100-150 Ma, associated with accretionary structures indicates that the current subdivision into time-bounded orogenies such as Acadian, Variscan, etc. is in need of revision into long-lived spatially distinct orogenies early in the convergence history followed by widespread deformation during continental collision. E-an Zen then indicated the problems of identifying the protolith after metamorphism. He proceeded to show the metamorphic consequences of emplacing nappes of various thicknesses as first the pressure increases followed by an increase in the temperature and then cooling associated with uplift and erosion. W.E. Stephens also dealt with the consequences of nappe emplacement upon the generation of "S"-followed by "I"-type magmas as pelitic rocks melt first followed by plutonic igneous rocks. This together with Pb-isotope signatures may indicate the nature of the source, however considering the allochthonous nature of most orogens this may not coincide with terrane boundaries on the surface. M.B. Stephens reviewed the metallogenic consequences of terrane interaction showing the association of different kinds of deposits with specific tectonic environments, especially emphasizing the massive sulphide suite.

There followed a day devoted to a general overview of terranes in Iberia. E. Martinez-Garcia provided the framework by subdividing the Iberian Massif into 26 terranes some of which represent strike-slip repetitions of one another. These may be grouped into terranes from (i) a deformed continental margin, (ii) a strongly deformed oceanic marginal area, (iii) a less deformed margin and oceanic area, and (iv) terranes accreted after the main amalgamation. Accretion is inferred to have taken place prior to the early Ordovician, in the Early Devonian and in Carboniferous times. The seven following papers dealt with a traverse from inboard in the northeast to outboard in the southwest. R.H. Wagner started by reviewing the repetition of turbiditic-shelf Carboniferous sedimentation interspersed with four phases of deformation in the Palentian area. E. Martinez-Garcia dealt with the Late Precambrian-Permian miogeoclinal development of the Asturian terrane which was deformed by thin-skinned tectonics in the Late Carboniferous. A. Perez-Estuan and co-workers described the West Asturian Leonese terrane as a series of shallow water Paleozoic sediments interrupted by turbidites in the Late Ordovician, all resting unconformably upon Upper Proterozoic clastic sediments. These rocks were affected by thin-skinned and polyphase deformation accompanied by low- to medium-grade metamorphism and intruded by syn- to post-kinematic granitoid plutons. A. Ribeiro and E. Pereira characterized the Galician-Castillian terrane as a pile of four allochthonous units transported from the west: Silurian para-autochthon at the base, Lower Paleozoic continental rift to oceanic magmatism with high-pressure Variscan metamorphism, ophiolite, and Precambrian/Cambrian basement at the top. C. Quesada interpreted the Ossa-Morena Zone as two Precambrian terranes (Sierra Albarrana and Valencia de las Torres - Carro Muriano) amalgamated in the Late Precambrian (Cadomian-Pan African) overlain by Paleozoic overstep sequences and cut by major sinistral shear zones and Late Paleozoic plutons. J.T. Oliveira showed that the South Portuguese terrane is separated from the Ossa-Morena Zone by an inverted ophiolite suite. The South Portuguese terrane is made up of Devonian clastics, bimodal volcanics with massive sulphides of the Pyrite Belt and Carboniferous turbidites of northerly provenance, all thrust toward the south during late Devonian-Carboniferous accretion with the Ossa-Morena Zone. E. Banda showed that the crust beneath the south Portuguese terrane is distinct from that beneath the rest of Iberia which is generally composed of three layers totalling approximately 30 km in thickness.

The next day saw some elaboration of the characteristics of the Iberian terranes in terms of igneous, tectonothermal, stratigraphic and paleontological data. Igneous papers dealt with the petrology, geometry and ages of plutons and their contact metamorphism and relationship to deformation. Tectonothermal evolution of terranes in the axial zone of the Pyrenées and in ophiolitic complexes in Iberia was expounded, and a comparison between the terranes in the South Portuguese Zone and southwest England was made. Stratigraphic analyses of the Late Precambrian and Early Paleozoic in the southwestern Spanish Meseta, central Ossa-Morena terrane and in central Portugal were presented. Paleobiogeography of Late Cambrian trilobites, Ordovician faunas and Devono-Carboniferous palynology of the South Portuguese Zone were applied to terrane analysis. The day ended with presentation of a model for the evolution of the Iberian terranes by E. Martinez-Garcia involving closing of the Hesperian Ocean beginning in the Early Ordovician, initial collision during Late Silurian-Early Devonian followed by progressive convergence throughout Devonian and Carboniferous and ending in the Permian.

The next day was devoted to a survey of data relating to Paleozoic terranes in Europe, specifically the French Hercynides, Armorica, the Silesian-Polish Massif, the Eastern Alps, the Caledonides in Scotland, Eire, Anglesey, Poland, Scandinavia and Spitsbergen. P. Matte presented a model for the Variscan Orogen in Western Europe involving the closure of two oceans: the Rheic and Galician-Massif Central oceans, between 420 and 280 Ma with initial collision occuring as early as 380 Ma ago. Migration of deformation, metamorphism and plutonism away from the sutures through time is a characteristic of the Variscan Orogen.

One day was devoted to the terranes in the Appalachian and Mauritanide-Rockelide Orogens. Appalachian papers dealt with various aspects of the terranes, such as the Grenvillian and Avalonian basements, sedimentology and accretionary history, plutonism and metamorphism. R.D. Dallmeyer and M. Villeneuve presented a comparison between an evolutionary model for the southern Mauritanides and southern Appalachians. They recognize three orogenic phases: (i) Pan-African I produced by the collision of a western block and the Western African craton yielding cooling ages of approximately 650 Ma, (ii) Pan-African II structures yielding approximately 560 Ma cooling ages, and (iii) Hercynian structures yielding approximately 280 Ma cooling ages. These are comparable to terranes and events recorded south of the Brunswick-Altamaha Magnetic Anomaly in the southern Appalachians. This session ended with a general paper by T.P. Trurnit on the sequence that terranes pass through during global tectonic megacycles.

The final day of the conference was devoted to map compilation workshops to define the legends for maps relevant to terrane analysis. These workshops were preceded by a lecture by J.D. Keppie on the methodology of producing metallotectonic maps as one of the products of Project 233. The map workshops produced thematic map legends and the concept of time slice maps which could combine the various types of thematic data on individual maps. Projected map scale is 1:5,000,000 and the Decade of North American Geology Time Scale will be used. The first map will be a Preliminary Terrane Map of the Circum-Atlantic Paleozoic Orogens with the terranes classified as in the Circum-Pacific Terrane Map, and also showing overstep sequences and stitching plutons.

Two six-day field trips were run in association with the conference with the intent of critically evaluating the definition of the terranes in Iberia, and defining problems critical to their identification and accretionary history which could be tackled by co-operative research under the auspices of Project 233. The pre-conference field trip was lead by E. Martinez-Garcia and J. I. Gil Ibarguchi, and involved a geotraverse along the northern coast of Spain. The post-conference field trip involved a geotraverse across the southern terranes in Spain from Toledo to Huelva, and was led by E. Martinez-Garcia, P. Herranz, M.A. de San Jose, A. Perejon, J. M. Gonzalez-Casado, A. Pieren, O. Apalategui, L. Eguiluz and J.L. Hernandez-Enrile. Two excellent guide books were prepared and the trips were very well run. A typical daily schedule involved a full day (0830-1930 hours) of field work followed by an evening workshop — intensive, but very stimulating! All participants learned a great deal about Iberian geology which would have been difficult any other way as most of the literature is in Spanish or Portuguese. As a result of the intense discussion throughout the two trips, a sharper definition of the terranes in Iberia will be available for the Preliminary Terrane Map of the Circum-Atlantic Paleozoic Orogens. Participants should also have a clearer idea of how to define terranes in their own parts of the orogens as a result of these working field trips.

A program with abstracts and a list of participants was published for the meeting. A volume of collected papers will be published.

Enrique Martinez-Garcia and his colleagues are to be congratulated on organizing such an excellent conference and field trips, and for publishing the first treatment of Iberian geology in terms of terranes in English.

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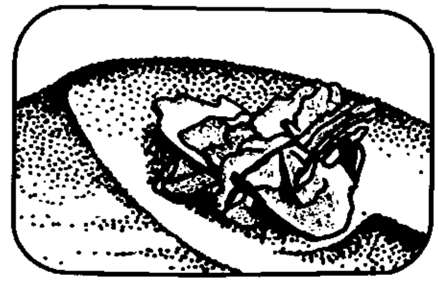

SLEADS (Salt Lakes, Evaporites, Aeolian Deposits) Workshop

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Although originally designed to focus on geological and environmental research in the Australian arid zones, the last two SLEADS conferences have included a much broader spectrum of international involvement (see *Palaeogeography, Palaeoclimatology, Palaeoecology* v. 54). This workshop, the fifth of its kind and held at Australian National University in Canberra 30-31 March 1987, saw papers presented by scientists from six nations, discussing regions from Saskatchewan to India, China, and, of course, Australia. Unfortunately, the collected papers from this conference will not be published except in the workshop abstracts (available from Patrick De Deckker, same address as above).

In his discussion of the late Pleistocene megalake paleohydrological problem, John Chappell demonstrated that if evaporation rates and groundwater regimes were held constant, then under steady state conditions, either rainfall or runoff must increase in order to fill the paleolakes to the levels that they occupied previously. Using conical lake geometry and a dynamic model with very rapid runoff followed by slow evaporation, however, the lakes could be maintained with only double the present rainfall. Chappell noted that to prove that the dynamic model applied would require more detailed survey and lake level fluctuation data. Unfortunately, the paper ignored groundwater effects and the potential differences in runoff as a function of vegetation changes, which elsewhere in Australia have had significant effects (Kershaw, pers. comm.).

Based on 7000 Australian Pleistocene dune orientations and 700 wind monitors, Bob Wasson *et al.* lucidly demonstrated that modern winds cross-cut dune field trends, especially near Perth and the Murray Delta. Late Holocene patterns do not match modern or 18 ka patterns. The modern wind