

# Penrose Conference: "Terranes in the Circum-Atlantic Paleozoic Orogens"

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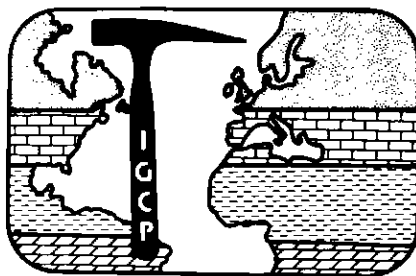
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individual granites and individual ore deposits, in cases where the critical geometrical relationships are unknown? For example, a number of speakers emphasized that lithophile metal deposits typically occur in composite granite terranes, and it was also noted several times that there appears to be a considerable time gap between the emplacement of the granite, and the formation of the deposit. Yet clearly, at places like Henderson, where good documentation is available, ore and granite are very close in time. So perhaps in areas where a time gap seems to exist, the right granite has not been matched with the right ore. Similarly, are we fooling ourselves when we define "differentiation" trends by comparing the chemistry of spatially associated granitoids in a composite intrusive terrane, when the intrusions may be temporally and genetically quite separate? Unfortunately in geology, as in other areas of modern life, our new wings, the machines which make it all so easy to accumulate data, are not very useful when it comes to making some of the fundamental decisions which so influence the final story.

In summary, this was a first class, truly international meeting. Its success is a credit to the organizers, and to the Canadian Institute of Mining and Metallurgy. If you are reading this report, you probably missed the event, and may be regretting it. But you can get the book of extended abstracts, and hopefully, the volume of full papers will be out soon.

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## Penrose Conference "Terranes in the Circum-Atlantic Paleozoic Orogens"

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The Penrose Conference on "Terranes in the Circum-Atlantic Paleozoic Orogens" was held at Liscombe Lodge, Nova Scotia, 27 May to 2 June 1985. A total of 71 people participated in the Penrose Conference from the following countries: USA (29), Canada (9), U.K. (12), France (8), Norway (3), Sweden (3), and one from each of Poland, Czechoslovakia, Austria, Spain, Holland, Eire and Columbia. Financial support from International Geological Correlation Programme, International Union of Geological Sciences, National Science Foundation, Canadian Geological Foundation and the Geological Society of America is gratefully acknowledged and allowed many non-North Americans and five students to attend the Conference.

The Conference began and ended with a session dealing with terrane vernacular as defined in the Cordillera and circum-Pacific region. This was compared with its usage in the circum-Atlantic area. By the end of the Conference it was generally realized that there had been varying degrees of misuse in the circum-Atlantic area. It was also generally agreed that the circum-Pacific terminology was appropriate for the circum-Atlantic also, however workers in the latter region should be more careful in their application of terms. During the opening session, several fundamental questions emerged such as (1) What rock properties distinguish normal, oblique and transcurrent accretion?; (2) What controls the presence/absence and nature of plutonism and metamorphism?; (3) Is it possible to estimate the thickness of continental crust being accreted and, if so, how?; (4) What criteria distinguish pre- and post-accretionary movements?

The next session dealt with the role of various geological specialities in terrane analysis. Dr. B. Bluck (Glasgow, U.K.) demonstrated the application of sedimentology and stratigraphy to terranes with examples from the Himalayas and the Midland Valley of Scotland. Upward-coarsening sediments characterize the Siwalik trough in the Himalayas and record the emplacement of thrust sheets. On the other hand, alluvial fans in Scotland all fine upward and the Midland Valley basins contain fragments a source for which cannot be found in either the Southern Uplands or the Dalradians. An accretionary mechanism involving both strike-slip faulting and thrusting was proposed. Dr. D.L. Bruton (Oslo, Norway) showed that faunal province boundaries record paleotemperature boundaries which do not necessarily coincide with terrane boundaries, and provided a classic example in one continuous stratigraphic section where the fauna alternated between Baltic and North American as the water depth changed from deep to shallow, respectively. Dr. R. Hon (Massachusetts, USA) outlined the difficulties in using correlations of igneous rocks based upon a common tectonic origin and protolith, due to factors such as mixing, alteration and petrogenetic controls. Dr. P.G. Andreasson (Lund, Sweden) illustrated how contrasting P-T ratios, deviating P-T time paths and different tectono-metamorphic histories can be used to distinguish terranes, and pre- from post-accretionary metamorphism. Dr. P. Lapointe (Ottawa, Canada) outlined the principles of paleomagnetism in terrane analysis which allows the construction of pre-accretionary paleogeography and the time of accretion. Paleomagnetic distinctions are presently limited to latitudinal movements greater than 5° or ≈500 km and there are no longitudinal constraints. Thus, it may not always be possible to distinguish paleomagnetically geologically-defined terranes. Complications may arise where the rock and the magnetization ages are not synchronous, e.g. in overprinting remagnetization or where various minerals with different Curie Points contribute to the observed magnetization. Dr. J.P. Lefort (Rennes, France) demonstrated the characteristic magnetic and/or gravity signatures associated with some terranes and terrane boundaries which could be used in tracing terranes beneath cover rocks or beneath the sea. However, caution was advised because several instances were cited where changes in magnetic and/or gravity patterns occur within one terrane due to factors such as metamorphic gradients and plutonic bodies. Also long wavelength anomalies relate to deep structures and may not relate to terrane boundaries at the surface. Dr. K.D. Nelson (New York, USA) illustrated how seismic data allows the three-dimensional shape of terrane boundaries to be traced provided they possess some seismic expression.

This general session was followed by a

state-of-the-art tour of the terranes in the circum-Atlantic Paleozoic Orogens. Format for this tour involved a general introduction to each region followed by informal discussion of terrane problems in each geographical area. Dr. R.A. Gayer (Cardiff, UK) showed that Greenland consists of one terrane with overthrust miogeocline (and basement) in the East and North Greenland fold belts. Dr. D.G. Gee (Uppsala, Sweden) graphically illustrated that Svalbard consists of at least three terranes juxtaposed by both thrusting during accretion followed by post-accretionary dispersal by strike-slip faulting. Dr. M. Stephens (Uppsala, Sweden) presented a masterful overview of the complexity of the terranes in the upper allochthons of the Scandinavian Caledonides in which most terrane boundaries are thrusts of both Finnmarkian and Scandian origin. Dr. P.A. Ziegler (Der Haag, Netherlands) presented a paleogeographic/palinspastic view of Europe during the Paleozoic as an introduction to a review of terranes in the UK by Dr. N.J. Soper (Sheffield, UK) and western Europe by Dr. P. Matte (Montpellier, France). These areas elicited much discussion, with many differing terrane maps, the demonstration of some of the complexities in well-studied areas, and the use of techniques such as geochemistry in terrane correlation.

The focus of the Conference then switched to north-west Africa summarized by Dr. J.P. Lecorche (Marseilles, France), Dr. A. Pique (Strasbourg, France) and Dr. M. Villeneuve (Marseilles, France). This trio covered a vast area in a very able fashion defining the large terranes and groups of terranes such as eugeoclinal and calc-alkaline, with further subdivision a project for the future. H. Duque-Caro (Bogota, Columbia) presented the terrane map of Columbia made in conjunction with the US Geological Survey. While most of the terranes are Tertiary, a series of Paleozoic terranes sparked considerable interest. Dr. T. Anderson (Pittsburg, USA) outlined the terranes of northwest South America and Central America highlighting the Paleozoic fragments isolated in a complex Mesozoic terrane complex. Dr. R.G. Hatcher (Columbia, USA) unveiled a new terrane map of the Appalachians based upon structural and geophysical maps. There followed much discussion centred around different terrane maps for various parts of the Appalachians. Most of the differing maps for here and other parts of the orogens result from inconsistent use of the terrane terminology, problems we hope will be resolved with more careful usage in the future.

A one-day field trip to examine the Meguma Terrane and structural/geochronological

and sedimentological constraints on its accretion to the Avalon Composite Terrane provided a welcome break to the Conference proceedings. Several evenings were taken up with the many excellent poster displays from around the Atlantic, and provided an essential ingredient of personal discussion to the Conference. On the last day Dr. E. Martinez-Garcia (Oviedo, Spain) provided a prelude to the upcoming Terrane meeting in Oviedo in September 1986.

During the Conference, National Leaders and representatives of the various countries met to discuss the goals of this IGCP project. Plans call for collaboration between various countries in joint research and sharing of laboratory facilities using the project as an umbrella and central clearing house. The short-term goals of the new project are to produce a circum-Atlantic terrane map and accompanying memoir and a series of volumes as collected papers from the annual conferences.

All in all, the Conference provided an exciting start to the new IGCP Project #233 on "Terranes in the circum-Atlantic Paleozoic Orogens". In general, participants left feeling enthusiastic about the goals of the new project.

Ms received 8 November 1985.

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\*A partial list of the subjects covered in the annual review issue of *Geotimes*, which returns next February.



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