Project 1.5.2: Palaeomagnetism of Neoproterozoic surface samples and continuous drill cores from Congo and comparison with coeval Australian data

Aims:

In collaboration with the Geological Survey of Western Australia, recent analyses of drill cores from Australia have yielded a near-continuous record of palaeomagnetic inclination for the Neoproterozoic. In this study we aim to determine palaeomagnetic information for rocks of similar age from the Congo Craton, and compare the data with those from Australia. The primary aim is to test hypotheses about the configuration of these continents as part of Rodinia as well as during the transition from Rodinia breakup to West Gondwanaland assembly.

Progress:

Low-inclination stable remanence has been isolated during palaeomagnetic study of three deep drill-holes in the Officer Basin, Western Australia. The result supports a low-latitude position for Australia throughout most of Neoproterozoic and Early Paleozoic time (TSRC Publ. #134).

Palaeomagnetic measurements have been completed on one deep drill core from Zambia, and yield steep magnetisations indicating that Congo may have been close to the pole at ~750 Ma. Because of the lack of field tests constraining the age of magnetisation, we have decided that a more complete and better interpreted picture can be obtained by combining this study with current work on 765 Ma basalts sampled on surface by Dr Wingate in northwestern Zambia. This work is almost complete.

The TSRC is supporting the fieldwork of a PhD student, Mr Joseph Batumike, at the University of Lubumbashi, D.R. Congo. Mr Batumike is studying the Neoproterozoic sedimentary succession of the Kundelungu Plateau, and is expected to collect samples from company drill cores that can be oriented (2 cores, ~150 samples each), as well as correlative surface samples. Igneous rocks identified as being capable of providing absolute age constraints on sedimentation will be sampled for SHRIMP geochronology. A preliminary report received from Mr Batumike in April 2000 indicated that he was actively engaged in studying industry drill cores in the Kipushi region.

Outcomes: TSRC Publ # 134.

Aims for 2001:

Essentially continuous palaeomagnetic information will be obtained from drill cores from Zambia and the Kundelungu Plateau in D.R. Congo. Age calibration will be obtained by SHRIMP U-Pb dating of igneous rocks in the succession. The results will be compared with those obtained from drill cores in Australia, and with information from other continents, to elucidate the configuration of continents during Rodinia breakup and Gondwanaland assembly.

Participants: Drs S. Pisarevsky and M.T.D. Wingate, Professor C.McA. Powell, scientists of the Geological Survey of Western Australia, and researchers in southern Africa.

Project 1.5.3: Dating the Congo-Zimbabwe collision

Aims:

The aims are to map the structure of a newly-discovered whiteschist zone in southern Zambia, to date the age of the minerals, and to evaluate the possibility that the whiteschist zone represents a major suture between the Zimbabwe and Congo continental block. The significance of the research is that if the whiteschist zone is young (ca. 525 Ma) as suggested by preliminary work in northern Zimbabwe, the Gondwanaland supercontinent may not have been fully assembled until the Early Cambrian. The expected outcomes will be a structural map and cross-section connecting the Congo and Zimbabwe cratons, Ar/Ar and U/Pb isotopic determinations of the age of the rocks, and a synthesis of the geotectonic evolution of this part of Gondwanaland. The work is being done as part of a collaborative research program involving Leicester University and The University of Western Australia.

Progress:

Work in 2000 has concentrated mainly on the geotectonic evolution of the rare, high-pressure whiteschists that occur throughout central southern Africa. Considerable detail has been paid to the petrological and tectonothermal evolution of the northern Zimbabwe examples and results indicate that they are characterised by very-high-pressure assemblages (i.e. >12 kbar) and hence are part of an 'A' type high-pressure (HP) – ultra-high-pressure metamorphic (UHPM) belt. These high-pressure whiteschists and associated N-MORB-type mafic eclogites are thus the result of collision and continental subduction between the Congo and Zimbabwe Cratons. The age of collision remains controversial; however, the dating of key fabrics using high-precision Ar/Ar isotopes will be conducted when the facility is running in mid-2001.

Outcomes:

The project has so far generated 2 conference proceedings and a manuscript that is in review (*Journal of Petrology*).

Aims for 2001:

1) Detailed geochemical, petrological and thermobarometric work on the Zambian whiteschists in order to determine their tectonothermal history and whether they represent HP-UHPM rocks.
2) Ar/Ar dating of key fabrics in order to determine age of HP-UHP metamorphism, and their exhumation history.
3) SHRIMP dating of key specimens from both whiteschists occurrences and the Chewore Ophiolite to constrain further the geotectonic history of the region.
4) If possible, perform Sm/Nd isotope analyses on key specimens to constrain further the geotectonic history of the region.

Participants: Drs S. Johnson and M. Wingate, Professor C.McA. Powell, Mr B. De Waele (PhD student), Dr F. Tembo and Mr K. Katongo (University of Zambia), Professor T. Rivers (Memorial University, Canada) and Dr Ben Mapani (University of Zimbabwe).