

the minimum extent of a recently-recognised 1070 Ma Large Igneous Province (LIP) extending from the western margin of Australia well into the centre of the continent, where it includes the Giles layered igneous complex, and related dyke swarms. An older suite of dykes in the northwest Yilgarn craton, dated at about 1200 Ma, is coeval with the 1.2 Ga Boyagin, Fraser, Ravensthorpe, and Wheatbelt dyke swarms located elsewhere along the Yilgarn craton margins. Collectively, these dyke swarms document the widespread effects of the Albany Fraser Orogeny over much of the Yilgarn Craton at 1.2 Ga.

Samples of the c. 1070 Ma Stuart dyke swarm and Kulgera sills in central Australia were collected for SHRIMP U-Pb geochronology, but did not yield minerals useful for precise dating. However, northwest-trending dykes located in the easternmost Musgrave Block, south of the Kulgera sills, have yielded a concordant SHRIMP U-Pb age of 812 Ma. These

dykes probably represent a continuation of the rifting events that commenced in central and eastern Australia with intrusion of the Gairdner dyke swarm at 825 Ma. Palaeomagnetic studies of these rocks, including a baked-contact test, will be completed in 2003. New collections of sedimentary and mafic igneous rocks from late Neoproterozoic outcrops (c. 830–540 Ma) of the northwest Officer Basin will be analysed palaeomagnetically in late 2003.

Outcomes: TSRC Publs #50, 53, 86, 94, 111, 123, 130, 134, 150, 168, 180, 191, and two government reports (one in press). Several lectures and conference papers have been presented.

Participants: Drs M.T.D. Wingate, S.A. Pisarevsky, D.A.D. Evans, Z.X. Li, L.B. Harris, M. Gole (AusQuest Limited), Ms Linda Glass (RSES, ANU), and scientists of the Geological Survey of Western Australia.

Project 1.5.1B: Regional geology and geochronology of West Gondwanaland continents in southern Africa

Aims:

This project, conducted in collaboration with field geologists working in southern Africa, is designed to provide critical geochronological data for selected targets, and to integrate this information with local geological knowledge to constrain the nature and timing of key geological events in the Kaapvaal, Zimbabwe, Congo, and Tanzanian cratons and intervening Meso- and Neoproterozoic orogenic belts. The study aims to elucidate the tectonic evolution of these cratons during Rodinia assembly and breakup and subsequent amalgamation of Gondwanaland.

Progress:

Several samples collected by workers in Botswana, and critical to understanding the Proterozoic evolution of the northern

Kalahari craton, have been dated; several journal articles are in preparation. In collaboration with geologists from the Royal Museum for Central Africa, Belgium, additional work has been conducted to clarify U-Pb results obtained for Mesoproterozoic granites and rhyolites of the northeast Kibaran Belt. Two papers are in preparation that integrate the geochronology with geological and geochemical information, and revise the tectonic history of this important orogenic belt.

Outcomes: TSRC Publs #110, 125, 142, 144, 151, and articles in preparation. Several conference papers have been presented.

Participants: Drs M.T.D. Wingate, D.A.D. Evans, R. Mapeo (Botswana), H. Kampunzu (Botswana) and L. Tack (Belgium).

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

Aims:

Recent analyses of drill cores from Australia have yielded a near-continuous record of palaeomagnetic inclination for the

Neoproterozoic. In this study we 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:

Our palaeomagnetic study of 765 Ma basalts in northwest Zambia, which are situated on the southern edge of the Congo Craton, reveals two ancient components. A component carried by SD magnetite and haematite yields a palaeopole close to previous results for the 700-800 Ma Mbozi complex in Tanzania and may be primary. A secondary component, carried mainly by haematite, yields shallow palaeomagnetic directions similar to those of the -550 Ma Sinyai Metadolerite of central Kenya. A stable low-inclination remanence has been isolated during palaeomagnetic study of two deep drill-holes in the

Officer Basin, Western Australia. Collectively, the observations support low latitude positions for both Australia and Congo throughout most of the Neoproterozoic and Early Palaeozoic. However, the Congo Craton appears to have undergone large rotations that were not experienced by Australia, indicating that the two cratons were not juxtaposed within the Rodinia supercontinent.

Outcomes: TSRC Publs #134, 142, 150, 180, and in preparation.

Participants: Drs M.T.D. Wingate, S.A. Pisarevsky, R.M. Key (British Geological Survey), Mr B. De Waele (PhD student), scientists of the Geological Survey of Western Australia, and researchers in southern Africa.

Project 2.1: Neoproterozoic Laurentian margin reconstructions

Aims:

North America (Laurentia) was situated at the centre of the end-Mesoproterozoic (1.0 Ga) supercontinent, Rodinia. The Neoproterozoic breakup of this supercontinent resulted in the development of passive margin sequences around Laurentia. This project attempts to establish the nature and character of the continental blocks that lay outboard of Laurentia. It involves a study of the timing and character of both the Laurentian margin sequences and the potential conjugate sequences preserved in South America, Baltica, Siberia, Eastern Australia, Antarctica and crustal blocks in China and Africa.

Progress:

Work over the last 12 months has concentrated on understanding the relations between West Laurentia and its conjugate margin elements in South America and Baltica.

- Dalziel's studies of the potential conjugate margins to the late Neoproterozoic rifted margins of proto-Appalachian/Caledonian Laurentia have continued with work in Scotland, Peru, Chile, and southern Africa. With graduate student Staci Loewy and co-supervisor James Connelly, the work in Scotland and Peru has demonstrated through geochronology and lead isotopic ratios that the

Arequipa-Antofalla massif of southern Peru and northern Chile is not a piece of Laurentia. Rather, it has affinities (based on the common lead) with the Kalahari craton of southern Africa.

- Cawood, Nemchin, Smith and Loewy have completed a study of detrital zircons from siliciclastic units of the Dalradian Supergroup. Ages of zircons range from 3.2 Ga to 0.5 Ga. Detrital zircons from the sub-Grampian Group basement and the Grampian Group are predominantly of Palaeoproterozoic and Mesoproterozoic ages with Archaean grains absent or rare. In contrast, the overlying Appin, Argyll and Southern Highland groups contain a significant contribution of Archaean-aged detrital zircon grains, some of which locally preserve evidence for late Palaeoproterozoic overgrowths dated at about 1.8 Ga. In addition, on concordia plots Archaean grains are slightly discordant with a lower intercept at around 1.8 Ga, suggesting that they were affected by a tectonothermal event at this time. Late Palaeoproterozoic and Mesoproterozoic grains also show evidence for overprinting by a tectonothermal event around 1.0-0.9 Ga. The overall age range of detritus, combined with sparse palaeocurrent data, is consistent with derivation from the Laurentian foreland, especially the Labrador-Greenland region.