The Archean anorthosite-monzogranite magmatic association of the Narryer Gneiss Terrane, Western Australia

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The Narryer Gneiss Terrane is located in the Yilgarn Craton, Western Australia [1]. A layered anorthosite-gabbro-ultramafic intrusion called the Manfred Complex [2] is exposed just northeast of Mount Narryer. The complex is about 3.73 Ma old based on U-Pb zircon geochronology [3]. It is engulfed and disrupted by two banded granite gneisses. Meeberrie gneiss is mainly derived from monzogranites that have U–Pb zircon ages of 3.68–3.60 Ga [3, 4], although minor components are as old as 3.73 Ga [5]. Dugel gneiss formed from younger monzogranite to syenogranite magmas emplaced at 3.38–3.35 Ga [3, 4, 5]. Because the Manfred Complex is older than all but one component of the gneisses, it has been thought to be unrelated to the major magmatic events that produced the monzogranitic intrusions.

We have sampled additional anorthositic rocks from the Narryer Gneiss Terrane and determined their ages by LA-ICPMS U-Pb zircon geochronology. These rocks include anorthosite, leucogabbro, gabbro, amphibolite and peridotite. Anorthosites and leucogabbros located near 7 Mile Bore, north of the Jack Hills give ages of 3.73-3.63 Ga, similar to the ages for the Meeberrie gneiss, whereas northeast of Mount Dugel, north of Billabidy well, leucogabbros formed at about 3.3 Ga, similar to ages for the Dugel gneiss. Northwest of Mount Dugel, the anorthosites formed at about 3.5 Ga; this age is similar to tonalitic to monzogranitic protoliths of the Eurada gneiss, emplaced at 3.49–3.44 Ga [5].

The correspondence of ages of anorthosites and monzogranites in the Narryer Gneiss Terrane suggests that these rocks may represent a previously unrecognized, but distinctive magmatic association of the Archean.

[1] Williams & Myers (1987) *WA Geol. Surv. Rpt.* **22**, 32 pp. [2] Myers (1988) *Prec. Res.* **38**, 309-323. [3] Kinny *et al.* (1988) *Prec. Res.* **38**, 325-341. [4] Myers & Williams (1985) *Prec. Res.* **27**, 153-163. [5] Nutman *et al.* (1991) *Prec. Res.* **52**, 275-300.

Most recent developments in AMS technologies

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In charge state 1+, molecular interferences can be efficiently suppressed in multiple collisions of ions with stripper gas atoms or molecules. This made a new class of AMS spectrometers possible using compact acceleration systems at terminal voltages of about 500 kV. At ETH an even more compact spectrometer was developed using a vacuum insulated high voltage platform operated at 200 kV (MICADAS). Such systems can be regarded as state-of-the-art, matching the requirements of high performance radiocarbon dating.

Recent investigations performed at ETH to explore the basic principle behind the detection technique in particular of radiocarbon at even lower energies has opened novel opportunities to further reduce size and complexity of radiocarbon detection systems. Here, the use of He as a stripper is the key to minimize energy and angular straggling in connection with charge exchange and molecule dissociation processes. Dissociation cross section of mass 14 molecules in He gas have been found to be fairly constant at energies between 40 and 100 keV and are sufficiently large to reduce the intensity of molecular beams extracted from a graphite target by 10-11 orders of magnitude. Another important fact is the high yield of charge state 1+ at energies as low as 45 keV where values of more than 75% have been observed.

In a proof-of-principle experiment, using ions at 45 keV as they are extracted from the source and a molecule dissociation unit kept at ground potential, the feasibility of radiocarbon dating measurements over the entire ^{14}C dating range have been demonstrated.

Apart form radiocarbon, He as stripper gas has also striking advantages for other radionuclides. In particular, the detection of actinides in charge state 3+ at stripping energies of about 300 keV will become possible at unparalleled efficiencies.