Australian Government
Geoscience Australia

AUSGEO news
ISSUE 92 Dec 2008

Foundations of South Australia discovered

Gawler Craton: half a billion years older than previously thought!

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Recent geochronology results obtained using Geoscience Australia's Sensitive High Resolution Ion Microprobe (SHRIMP) have identified Mesoarchean rocks (about 3150 million years old) in the eastern Gawler Craton, South Australia. These rocks are approximately half a billion years older than the oldest previously-dated rock from South Australia, making these the oldest rocks yet discovered in Australia outside the Pilbara and Yilgarn Craton areas of Western Australia.

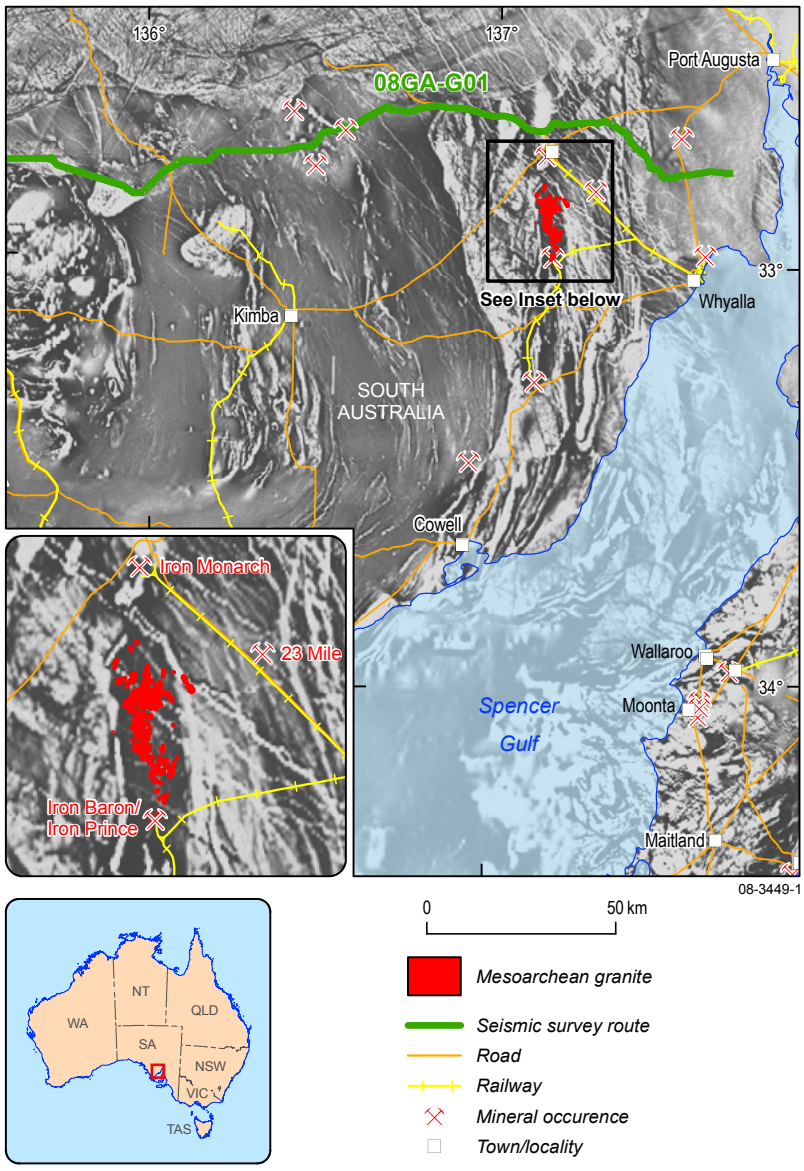

Figure 1. Magnetic image of the northeastern Eyre Peninsula showing the trace of the recently collected seismic line (bold green line), and the location of Mesoarchean granite (highlighted in red) between the Iron Monarch and Iron Baron mines (inset).

A series of seismic transects are being collected across selected regions of the Australian continent as part of Geoscience Australia's Onshore Energy Security Program. One of these seismic transects, collected in June 2008, traverses the northern Eyre Peninsula of South Australia (figure 1). When processed, the seismic data will provide an east–west cross-section of the eastern margin of the Gawler Craton. This region hosts significant uranium, geothermal, copper-gold, gold and iron resources. To assist the interpretation of the seismic data and the current geological mapping program of Primary Industries and Resources South Australia, a program of geochronology is underway to determine the ages of major rock units crossed by the seismic line. It was during the course of this project that this exciting and unexpected result was discovered.

Previous work in the Gawler Craton suggested that rocks of the northern Eyre Peninsula are dominantly Paleoproterozoic sediments, volcanics and intrusives (~2000 – 1700 million years old or Ma) deposited on late-Archean to earliest Proterozoic basement gneisses (~2450 Ma and ~2000 Ma). The presence of Mesoarchean inherited zircons as well as extremely evolved neodymium-isotopic ratios in some Proterozoic granites suggested the presence of Mesoarchean crust at depth beneath parts of the Gawler Craton (Creaser and Fanning 1993, Daly and Fanning 1993, Fanning 2008), but no surface rocks of this age have previously been identified. These new results are, therefore, the first direct evidence of the age and location of the foundations of the Gawler Craton.

These new results were obtained from Geoscience Australia's SHRIMP facility, which was commissioned earlier this year. The SHRIMP measures uranium and lead isotopes from tiny portions of zircon crystals and the results are then used to calculate the age of the crystal based on the natural decay rate of uranium to lead.

The newly identified Mesoarchean rock is a grey, gneissic granite, trending north–south between Iron Knob and Iron Baron (figures 1 & 2). The rock was originally mapped as part of the Lincoln Complex, a term for local Paleoproterozoic intrusives, but the new age data indicate that this rock is approximately twice as old as first thought, and forms basement to the iron-rich sediments of the Middleback Ranges which have been mined for iron ore since the late 1800s.

Figure 2. Outcrop of Mesoarchean granite.

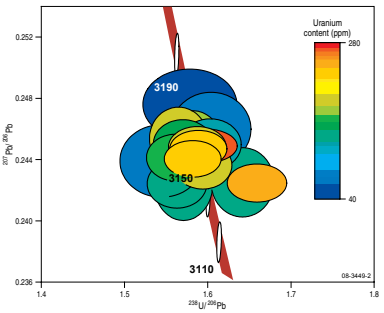

Figure 3. Geochronology results plotted on a uranium-lead concordia diagram showing concordant zircon ages of ~3150 Ma.

The first Mesoarchean results from this rock were such a surprise that additional samples were collected. Analyses of several additional samples have verified the Mesoarchean age of this granite (~3150 Ma: figure 3), and ongoing work is in progress to define the regional extent of rocks of this age.

For more information

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