Age constraints on iron formations in the Gawler Craton

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Introduction

Iron formations are recognised throughout the Gawler Craton, but many are without robust stratigraphic constraints. In order to develope a large-scale correlative framework for iron ore deposits across the Gawler Craton targeted geochonology of zircons separated from the iron formations has been undertaken. Chemical sedimentary and clastic iron formations from the major prospective areas of the Gawler Craton were collected from outcrop and drill core (Figure 1).

Figure 1. Gawler Craton with locations of iron formations sampled in this study. Modified after Davies M., 2000.

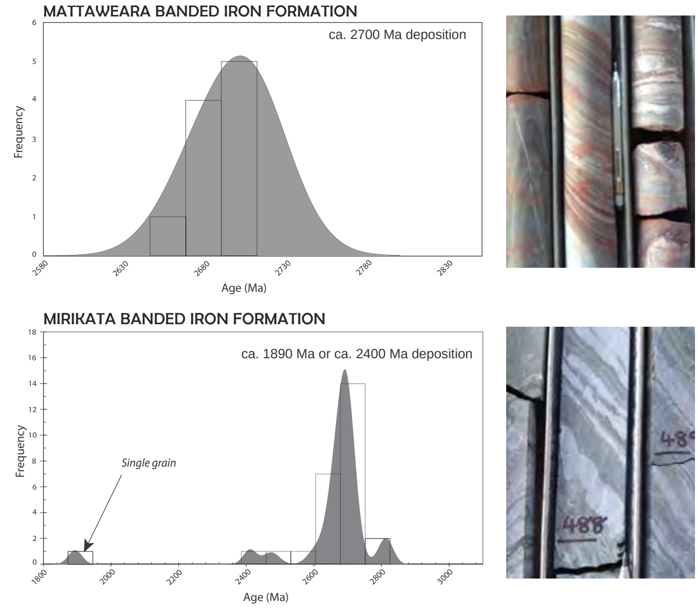

Figure 2. Probability density diagrams of zircon data with drill core image. Dark grey curve represents concordant (±10%) data. Highly discordant ages are not shown. All ages are quoted as $^{207}Pb/^{206}Pb$ ages.

MATTAWEARA BANDED IRON FORMATION: This sample is a finely banded hematite-chert BIF. The unimodal zircon ages suggests a restricted volcanic zircon source.

MIRIKATA BANDED IRON FORMATION: This sample is a finely laminated magnetite-chert BIF. There is a greater spread of zircon ages in this sample suggesting variable source regions. The maximum age of deposition is uncertains and may be ca. 1890 Ma based on a single zircon analysis, or a more reliable age estimate may be given by the multiple ca. 2400 Ma zircon grains.

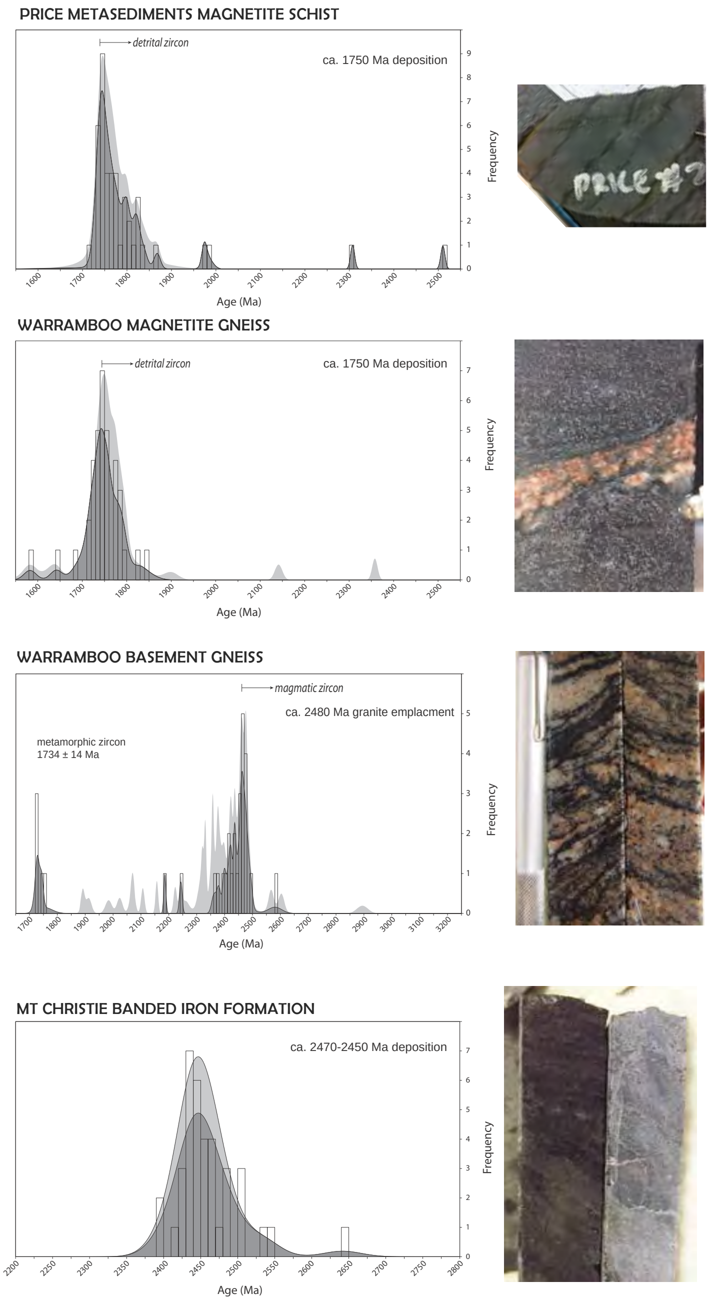

Figure 3. Probability density diagrams of zircon data with sample picture adjacent. Dark grey curve represents concordant (±10%) data. Light grey curve represents all data. All ages are quoted as $^{207}Pb/^{206}Pb$ ages.

PRICE METASEDIMENTS: This sample is a weakly deformed magnetite-chlorite schist. The maximum depositional age is given by the youngest zircon population at ca. 1750 Ma.

WARRAMBOO MAGNETITE GNEISS: This is a sample of the high grade magnetite gneiss at the Iron Road CEIP deposit. It is a migmatitic metasedimentary magnetite-feldspar-quartz-biotite-garnet± hematite gneiss. The maximum depositional age is constrained by ca. 1750 Ma detrital zircon and ca. 1730 Ma metamorphic zircon. The zircon ages correlate with the Price Metasediments indicating that these rocks may have formed part of a sequence of iron-rich sedimentary basins in the southern Gawler Craton.

WARRAMBOO BASEMENT GNEISS: This is a sample of the granitic gneiss at Warramboo and is magnetite barren. The magmatic zircon cores indicate the granitic protolith was emplaced at ca. 2480 Ma, with subsequent deformation at ca. 2440 Ma and ca. 1730 Ma. The relationship between the barren basement and the Warramboo magnetite gniess is interpreted to be a sedimentary unconformity.

MT CHRISTIE BANDED IRON FORMATION: This is a sample of the magnetite-quartz BIF from the Iron Road Gawler Project. Zircon ages indicate the formation was deposited in the early Paleoproterozoic. This age is consistent with ages from the surrounding garnet-cordierite Mt Christie gneiss (Reid et al. 2014)

Conclusions

- While only a limited number of zircons may be present in an iron formation they are a valuable tool in determining the age and stratigraphy of iron formations within the Gawler Craton.
- The variety of ages found in this study indicate that the Gawler Craton has a long history of iron formation in both chemical sedimentary and clastic rocks and suggests some periods of basin development were particularly favourable to iron formation.
- Zircon geochronology enables the regional correlations between iron formations to be explored and allows for more targeted exploration of iron-bearing rocks within stratigraphic units.

References

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