

213004.1: hydrothermal breccia, John Galt prospect

(Red Rock Formation; Red Rock Basin, Halls Creek Orogen)

IOH Fielding, Y Lu and S Morin-Ka

Location and sampling

DIXON RANGE SE52-06, TURKEY CREEK 4563
Warox Site SMKREE000041

Zone 52, MGA 417686E 8087453N
Sampled on 11 September 2013

This sample was collected from a pile of rocks at the bottom of a scarp at the John Galt prospect, about 13.5 km west-northwest of the Bungle Bungle Outcamp Ruins, 7.5 km south-southwest of the Lumuku Community and 2.4 km east of Corkwood Yard.

Geological context

The unit sampled is a rare earth element (REE)-rich breccia within a sandstone of the Red Rock Formation, Halls Creek Orogen. The Red Rock Formation consists of lithic quartz sandstone, pink feldspathic quartz sandstone, pebbly sandstone, conglomerate, siltstone, mudstone, basalt flows, and basaltic breccia (Phillips, 2023). The Red Rock Formation unconformably overlies sedimentary rocks of the Winnama Formation (Maidment et al., 2022) and occurs in thin fault-bound slivers along the Halls Creek Fault and larger fault-bound outcrops in the Osmond Range (Phillips, 2023). At this location, the sample was collected to date hydrothermal activity related to REE mineralization at the John Galt prospect. A sample of muscovite–chlorite schist from the Winnama Formation about 7.8 km to the north-northeast yielded a maximum depositional age of 1870 ± 6 Ma (GSWA 218318; Lu et al., 2018). A similar hydrothermal breccia from this location yielded a weighted mean $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 1608 ± 13 Ma, interpreted as the age of a hydrothermal event (GSWA 213005; Fielding et al., 2023).

Petrographic description

The sample is a xenotime–quartz breccia within a sandstone, consisting of about 60% xenotime, 20% quartz, 10% sericite, 8% lithic clasts, 1% hematite and 1% pyrite. Xenotime is translucent to opaque, euhedral, up to 1 mm in size, and contains abundant inclusions of quartz, as well as lesser hematite and pyrite. Quartz occurs as euhedral crystals that are mostly less than 4 mm in size, contain abundant fluid inclusions, and are often surrounded by the xenotime. Lithic clasts consist of poorly rounded, poorly sorted sandstone, with equigranular quartz, hematite, and sericite. The sample is not deformed or metamorphosed. Late-stage quartz veinlets crosscut the xenotime–quartz breccia.

Xenotime morphology

Xenotimes from this sample are translucent to opaque, and anhedral to euhedral. The crystals are up to 1 mm long, rich in inclusion, and surround euhedral quartz within the groundmass of the sample. A backscattered electron (BSE) image of a representative xenotime is shown in Figure 1.

Analytical details

This sample was analysed on 20 October 2014, using SHRIMP-B. Xenotimes were analysed in plugs cut from polished thin sections, following procedures described by Fletcher et al. (2010). During the analytical session, a 30 mm Köhler aperture was used to obtain a primary beam diameter of 10–15 mm. Retardation was applied to reduce scattered ions. U–Pb isotopic data were calibrated against reference xenotime MG1, and matrix corrections were applied using secondary standards Xenol, BS-1 and z6413 following Fletcher et al. (2004). An instrumental fractionation correction on ^{204}Pb -corrected $^{207}\text{Pb}/^{206}\text{Pb}$ ages was applied using Xenol by the method of Fletcher et al. (2004). Calibration uncertainties are included in the errors of $^{238}\text{U}/^{206}\text{Pb}^*$ ratios and dates listed in Table 1 (provided in the Links section). Common-Pb corrections were applied to all analyses using contemporaneous isotopic compositions determined according to the model of Stacey and Kramers (1975).

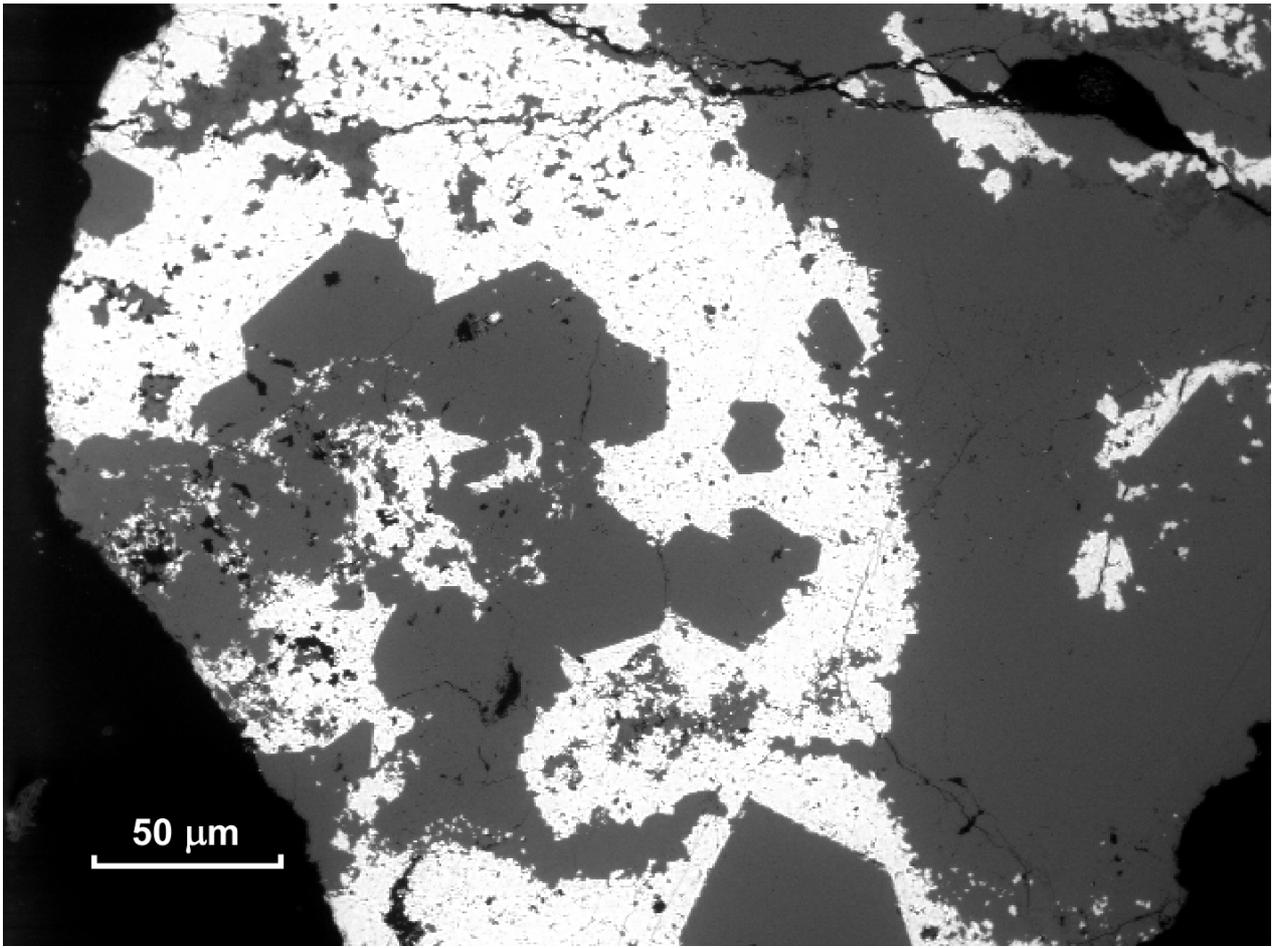


Figure 1. Backscattered electron image of a representative xenotime from sample 213004: hydrothermal breccia, John Galt prospect. Dark grey minerals are quartz, white minerals are xenotime, and the black areas are epoxy

Results

Thirty-one analyses were obtained from seven xenotimes. Results are listed in Table 1 and shown in a concordia diagram (Fig. 2).

Interpretation

The analyses are concordant to strongly discordant (Table 1), and can be divided into two groups, based on their $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ ratios.

Group M comprises nine analyses of four xenotimes (Table 1), which yield a weighted mean $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 1619 ± 9 Ma (MSWD = 1.9).

Group P comprises 22 analyses of seven xenotimes (Table 1), which yield $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ dates of 1599–1367 Ma.

The date of 1619 ± 9 Ma for the nine analyses in Group M is interpreted as the age of a hydrothermal event. The dates of 1599–1367 Ma for the 22 analyses in Group P are interpreted to reflect loss of radiogenic Pb.

Alternatively, all the analyses in Groups M and P define a discordia with an upper intercept date of 1597 ± 9 Ma and an imprecise lower intercept date of 676 ± 52 Ma (MSWD = 1.06), indicating a Neoproterozoic Pb loss event.

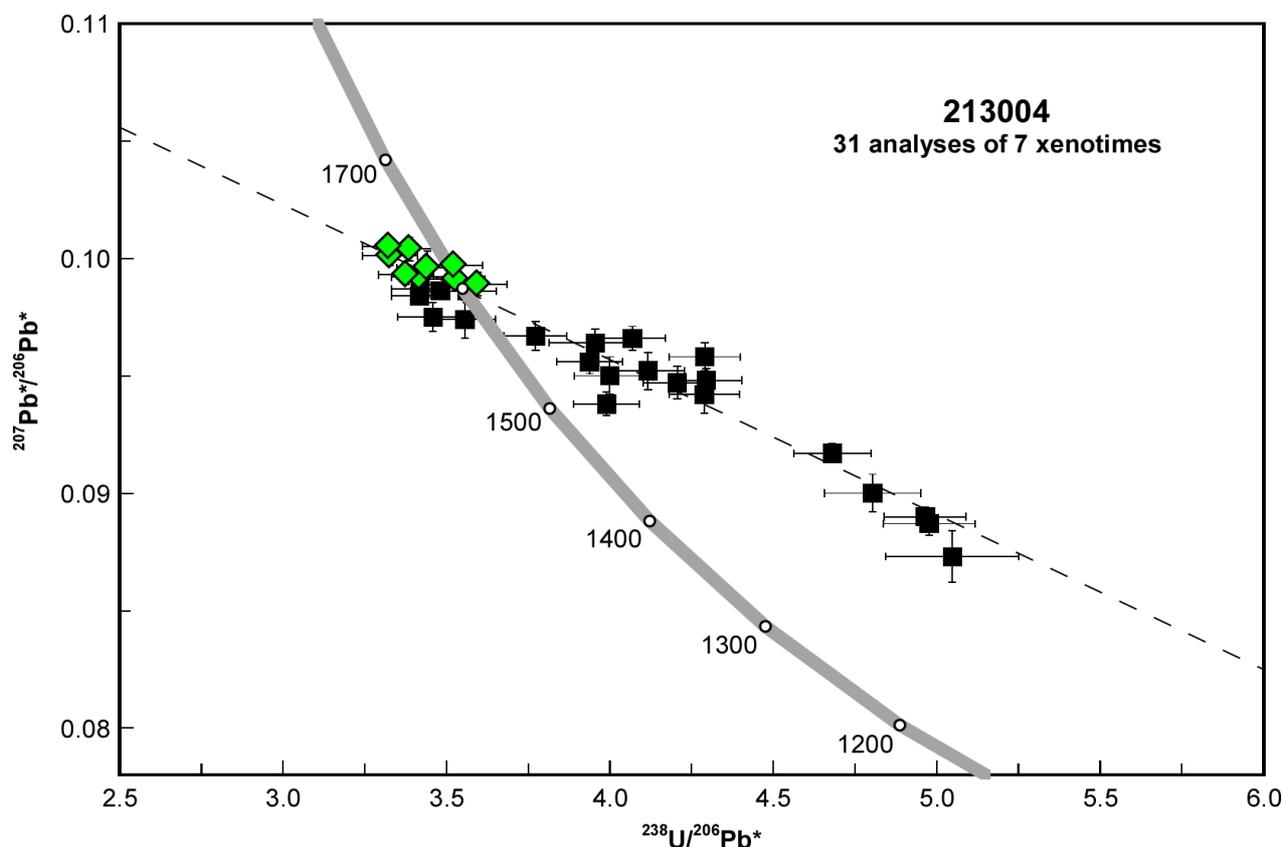


Figure 2. U–Pb analytical data for xenotimes from sample 213004: hydrothermal breccia, John Galt prospect. Green diamonds indicate Group M (hydrothermal xenotimes); black squares indicate Group P (radiogenic-Pb loss). The dashed line indicates a discordia regression through all data in Groups M and P

Links

Table 1. Ion microprobe analytical results for xenotimes from sample 213004: hydrothermal breccia, John Galt prospect: [213004.1.Table1.xls](#)

Introduction to geochronology information: [Intro_2023.pdf](#)

References

- Fielding, IOH, Lu, Y and Morin-Ka, S 2023, 213005.1: hydrothermal breccia, John Galt prospect; Geochronology Record 1903: Geological Survey of Western Australia, <www.dmirs.wa.gov.au/geochron>.
- Fletcher, IR, McNaughton, NJ, Aleinikoff, JA, Rasmussen, B and Kamo, SL 2004, Improved calibration procedures and new standards for U-Pb and Th-Pb dating of Phanerozoic xenotime by ion microprobe: Chemical Geology, v. 209, no. 3, p. 295–314.
- Fletcher, IR, McNaughton, NJ, Davis, WJ and Rasmussen, B 2010, Matrix effects and calibration limitations in ion probe U-Pb and Th-Pb dating of monazite: Chemical Geology, v. 270, no. 1, p. 1–44.
- Lu, Y, Wingate, MTD, Maidment, DW and Phillips, C 2018, 218318: muscovite–chlorite schist, Palms Yard; Geochronology Record 1544: Geological Survey of Western Australia, 7p., <www.dmirs.wa.gov.au/geochron>. [View Reference online](#)
- Maidment, DW, Lu, Y, Phillips, C, Korhonen, FJ, Fielding, IOH, Wingate, MTD, Kirkland, CL, Murphy, R, Tilhac, R, Poujol, M and Zhao, J 2022, Geochronology of metasedimentary and igneous rocks in the Lamboo Province, Kimberley region: reassessing collisional geodynamic models: Geological Survey of Western Australia, Report 215, 89p.
- Phillips, C 2023, Sedimentology and revised stratigraphy of the Kimberley Basin, Western Australia, Report 241.
- Stacey, JS and Kramers, JD 1975, Approximation of terrestrial lead isotope evolution by a two-stage model: Earth and Planetary Science Letters, v. 26, p. 207–221.

Recommended reference for this publication

Fielding, IOH, Lu, Y and Morin-Ka, S 2023, 213004.1: hydrothermal breccia, John Galt prospect; Geochronology Record 1902: Geological Survey of Western Australia, WA Geology Online, Explanatory Notes extract viewed 5 July 2023.

<www.dmirs.wa.gov.au/geochron>

Data obtained: 20 October 2014

Date released: 30 June 2023

This page was last modified on 19 June 2023.

Grid references in this publication refer to the Geocentric Datum of Australia 2020 (GDA20). All locations are quoted to at least the nearest 100 m.

Capitalized names in text refer to standard 1:100 000 map sheets, unless otherwise indicated.

WAROX is GSWA's field observation and sample database. WAROX site IDs have the format 'ABCXXXnnnnnSS', where ABC = geologist username, XXX = project or map code, nnnnn = 6 digit site number, and SS = optional alphabetic suffix (maximum 2 characters).

Digital data related to WA Geology Online, including geochronology and digital geology, are available online at the Department's [Data and Software Centre](#) and may be viewed in map context at [GeoVIEW.WA](#). For further information about this Geochronology Record, please contact geochronology@dmirs.wa.gov.au and quote the geochronology record and/or the sample number.

Further details of geoscience products are available from:

Information Centre

Department of Mines, Industry Regulation and Safety

100 Plain Street

EAST PERTH, WA 6004

Telephone: +61 8 9222 3459 | Facsimile: +61 8 9222 3444

www.dmirs.wa.gov.au/GSWApublications

Disclaimer

This product uses information from various sources. The Department of Mines, Industry Regulation and Safety (DMIRS) and the State cannot guarantee the accuracy, currency or completeness of the information. Neither the department nor the State of Western Australia nor any employee or agent of the department shall be responsible or liable for any loss, damage or injury arising from the use of or reliance on any information, data or advice (including incomplete, out of date, incorrect, inaccurate or misleading information, data or advice) expressed or implied in, or coming from, this publication or incorporated into it by reference, by any person whatsoever.



© State of Western Australia (Department of Mines, Industry Regulation and Safety) 2023

With the exception of the Western Australian Coat of Arms and other logos, and where otherwise noted, these data are provided under a Creative Commons Attribution 4.0 International License. (<https://creativecommons.org/licenses/by/4.0/legalcode>)