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First published online November 2010, doi: 10.1130/G31335.1

Archean detrital zircons in the Proterozoic Vishnu Schist of the Grand Canyon, Arizona: Implications for crustal architecture and Nuna supercontinent reconstructions

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Abstract

U-Pb dating of 1035 detrital zircons from 12 spatially distributed samples of the Paleoproterozoic Vishnu Schist (Arizona, United States) reveals a bimodal $^{207}Pb/^{206}Pb$ age probability diagram with peaks at 1.8 Ga and 2.5 Ga. Surprisingly, only 13% of detrital zircon ages overlap with the published depositional age range of 1750–1741 Ma. The similarity of the age distributions in all samples constrains possible suturing of crustal blocks to pre-Vishnu Schist deposition rather than during the peak 1710–1680 Ma deformation. Of all grains analyzed, 15% overlap at 2σ with the 1.84 ± 1 Ga Elves Chasm orthogneiss of the western Grand Canyon. This supports field evidence that the Vishnu Schist was deposited on 1.84 Ga arc basement rather than in a juvenile 1.75 Ga arc setting. Archean grains of 3.8–2.5 Ga compose 30% of all grains. A comparison of the ages older than 2.2 Ga from the Vishnu Schist (495 grains) with compilations of zircon ages from other cratons does not support provenances in the Wyoming, South China, or Siberian cratons; instead sources may be located in Gawler craton of Australia, North China craton, or Antarctica. If the detrital zircons were far-traveled, this is a new constraint for viable reconstructions of the Nuna supercontinent. However, given the high percentage of pre-1.8 Ga zircons, unexposed proximal basement sources are more likely, resulting in a model by which Vishnu sediments were derived from Mojave province crust that consists of Archean and 1.9–1.8 Ga crust, now in the subsurface, that was unroofed during Vishnu deposition.

Received 27 April 2010.
Revision received 12 July 2010.
Accepted 22 July 2010.

Articles citing this article

Synthesis of the 780–740 Ma Chuar, Uinta Mountain, and Pahrump (ChUMP) groups, western USA: Implications for Laurentia-wide cratonic marine basins
Geological Society of America Bulletin, May 1, 2017, v. 129, p. 607–624
Abstract Full Text Full Text (PDF)

Paleoproterozoic orogenesis and quartz-arenite deposition in the Little Chino Valley area, Yavapai tectonic province, central Arizona, USA
Geosphere, December 1, 2016, v. 12, p. 1774–1794
Abstract Full Text Full Text (PDF)

An imbricate midcrustal suture zone: The Mojave–Yavapai Province boundary in Grand Canyon, Arizona
Geological Society of America Bulletin, September 1, 2015, v. 127, p. 1391–1410
Abstract Full Text Full Text (PDF)

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Lithosphere, August 1, 2015, v. 7, p. 465–472

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Geosphere, February 1, 2014, v. 10, p. 49–65

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Geological Society of America Bulletin, September 1, 2013, v. 125, p. 1442–1467

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Basin formation near the end of the 1.60–1.45 Ga tectonic gap in southern Laurentia: Mesoproterozoic Hess Canyon Group of Arizona and implications for ca. 1.5 Ga supercontinent configurations

Lithosphere, February 1, 2012, v. 4, p. 77–88

Abstract Full Text Full Text (PDF)

Paleoproterozoic evolution of the Farmington zone: Implications for terrane accretion in southwestern Laurentia

Lithosphere, December 1, 2011, v. 3, p. 401–408

Abstract Full Text Full Text (PDF)

Revised regional correlations and tectonic implications of Paleoproterozoic and Mesoproterozoic metasedimentary rocks in northern New Mexico, USA: New findings from detrital zircon studies of the Hondo Group, Vadito Group, and Marquenas Formation

Geosphere, August 1, 2011, v. 7, p. 974–991

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