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M.J. Whitehouse, A.A. Nemchin, R.T. Pidgeon

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What can Hadean detrital zircon really tell us? A critical evaluation of their geochronology with implications for the interpretation of oxygen and hafnium isotopes

M.J. Whitehouse¹, A.A. Nemchin², R.T. Pidgeon²

¹ Swedish Museum of Natural History, Box 50007, SE-104 05 Stockholm, Sweden

² Department of Applied Geology, Curtin University, Perth, WA 6845, Australia.

Abstract

Rare Hadean zircon grains represent the only direct sample of the Earth older than 4.0 Ga. As such, they have tremendous potential to illuminate our knowledge of this period of Earth's history for which there is no extant rock record. In this study we revisit the existing dataset, supplemented by new analyses, to identify those grains from which a robust age may be inferred. This rigorous filtering approach identifies four distinct zircon growth events in the Hadean between ca. 4.4 Ga and 4.0 Ga, and allows a reassessment of conclusions made from the determination of the O- and Hf-isotope systematics in these grains. Notably, we find no firm evidence for involvement of supracrustal reservoirs in zircon genesis prior to 4.15 Ga and, while our filtered Hf-isotope data support interpretations for a mafic protocrust, there are insufficient analyses to constrain its evolution accurately. Clearly, further work is required and needs to be conducted in a systematic manner that first seeks to establish both the age and homogeneity of any given grain before proceeding to other types of analysis.

Introduction

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