EARLY ARCHAEOAN ZIRCON AGES FROM ORTHOGNEISSES AND ANORTHOSITES AT MOUNT NARRYER, WESTERN AUSTRALIA


Research School of Earth Sciences, Australian National University, G.P.O. Box 4, Canberra, ACT 2601 (Australia)

(Accepted August 31, 1987)

Abstract


U-Th-Pb isotopic analyses have been made with an ion microprobe of 20–30 μm areas within zircons from gneisses adjacent to the Mount Narryer quartzite, Western Australia, in which detrital zircons up to 4200 Ma old have been found. The cores of the zircons yield protolith crystallization ages of 3678 ± 6 Ma (95% confidence limits) for the Meeberrie banded monzogranite gneiss and 3381 ± 22 Ma for the Dugel syenogranite leucogneiss, in agreement with observed intrusive relationships. Zircons from inclusions of deformed leucogabbro and meta-anorthosite within the Dugel gneiss (formerly part of the Manfred layered igneous complex) are 3730 ± 6 Ma old. The remnants of the Manfred Complex are therefore the oldest rocks currently known on the Australian continent. Analyses of discrete post-magmatic grains and of overgrowths on older grains indicate an episode of subsolidus zircon growth in the region at 3296 ± 4 Ma, which is interpreted as a time of local metamorphism of the gneisses. Subsequently, the zircons have been rounded and embayed and have lost radiogenic Pb in both ancient and recent times.

All the zircon ages determined in this study are within the age range for detrital zircons in the Mount Narryer quartzite; it is therefore possible that these felsic gneisses and anorthositic rocks were a local source for some of the sedimentary material. However, the lateral extent of this early Archaean terrain and the source rocks for the rare 4100–4200 Ma old zircons in the metasediments are yet to be determined.

Introduction

The oldest known components of the Australian Archaean are situated in the Western Gneiss Terrain, an archeate belt of ortho- and paragneisses along the western and northwestern margins of the Yilgarn Block, Western Australia (Gee et al., 1981). The discovery of sedimentary zircons up to 4200 Ma old in high-grade quartzite from Mount Narryer in the northern part of this terrain (Froude et al., 1983) has instigated a search for exposed, very early Archaean crust in this region. The quartzite containing the old zircons forms part of a prominent, well-exposed sequence of deformed metasediments in tectonic contact with quartzo-feldspathic orthogneisses. An outline of the geology is given by Myers and Williams (1985), who also review earlier geochronological studies of the Western Gneiss Terrain. Myers and Williams distinguish two generations of gneisses at Mount Narryer: (1) the Meeberrie gneiss, a finely banded biotite-rich gneiss derived from porphyritic monzogranite (quartz-