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U-Th-He Dating of Ironstones – Examples from the Hamersley Iron Province and Darling Range Laterites from Western Australia

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The application of the U-Th-He technique to the dating ironstones has been demonstrated by Brander and Lippolt, (1999); Lippolt et al. (1998) and Mankopf and Lippolt (1997). The technique makes use of the small concentration of U and Th in these rocks and has the advantage over U-Pb dating in that inheritance problems are minimal and multiple atoms of He are generated from each U and Th atom decay. Nevertheless the problem of He loss is a real and the interpretation of the results needs to be considered carefully in terms of the geological history of the sample materials. In the present contribution we describe results of U-Th-He dating of samples of iron ore from the major Hamersley iron ore Province in Western Australia, and of samples of laterite, formed during the deep seated weathering that has resulted in the extensive regolith blanket that covers much of Western Australia. The timing and the mechanism of iron-enrichment from parent banded ironstones in the Hamersley Province is still not resolved. A supergene model is generally accepted, that envisages that iron enrichment occurred during weathering of the folded banded ironstones and that the initial martite-hematite ores were converted to micro-platy hematite during burial metamorphism (Morris, 1980). Early workers related the genesis of the ores to the development of the Tertiary land surface but more recent research suggests an older age. The presence of detrital platy hematite clasts in conglomerates of the ca 2.0Ga Wyloo Group, which overlays the Hamersley Group, is generally taken as a evidence for a 2.0Ga minimum age for supergene enrichment of the banded ironstones. However the present Th-U-He results record a younger Mesoproterozoic age. The significance of this age will be discussed in the light of the above age constraints. The dating of the laterites is a challenging problem because of their association with past climatic conditions. Formation of laterite during deep weathering of the rocks in the Darling Range area and elsewhere in Western Australia, occurred during a period of humid climatic conditions. The laterites form flat-topped caps on elevated topography that is eroded by the present river system and are generally considered to be of Tertiary age, although here there are few age constraints. U-Pb measurements of the age of the lateritic ironstones is theoretically possible but contamination by common Pb is a serious problem. We present Th-U-He results on samples of laterite from a restricted area about 60 km east of Perth. The results indicate a Miocene age, which confirms a Tertiary age for the laterites. These results are internally consistent and geologically reasonable and show that the Th-U-He technique holds great promise for dating ironstone products of deep weathering.

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