

Thesis Abstract

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This study explores the use of several different techniques to isolate and determine the age of lithic microdebitage in relation to archaeological deposits and associated sediments. Quartz microdebitage was identified on the basis of surface features and roundness index by applying scanning electron microscopy (SEM) and optical stereomicroscopy to archaeologically relevant sediments. Characteristics of the quartz microdebitage were compared with quartz grains from the same sedimentary layer. The observation of diagnostic features on quartz grains made it possible to discriminate between microdebitage and sedimentary background.

This investigation has established that microdebitage particles under 500 μm diameter are not easily resolved under optical stereomicroscopy, requiring the aid of SEM to discern between microdebitage and sedimentary quartz. It was also ascertained that no adverse effects on the optically stimulated luminescence (OSL) signal are measurable after exposure to SEM, provided that the electron beam is kept at, or under, 10 keV.

Sedimentary material previously excavated from the Jinnium rockshelter (Northern Territory) and Mushroom Rock West (Queensland) was used to determine the age of quartz microdebitage from the archaeological layers by applying the OSL dating technique. The microdebitage OSL signal behaves similarly to that of sedimentary quartz grains, and is subject to the same problems. The OSL single-aliquot regenerative-dose protocol (SAR) was successfully applied to the age determination of microdebitage. The modifications used for the dose

rate (due to particle size and shape) and for the calibration of the beta source (due to particle size) did not produce any inconsistencies or anomalous results. In the investigation of two archaeologically relevant sediment layers from the Jinnium rockshelter deposit, the minimum OSL age at 68 cm depth for the microdebitage was estimated as 4100 ± 900 years ($12,600 \pm 4000$ years using the central age model estimate, with 73% over-dispersion on the palaeodose), and, for the sedimentary material, a central age model of 5300 ± 800 years (with a minimum age model estimate of 1900 ± 400 years, and, 78% over-dispersion). At 115 cm in the deposit, the OSL central age model estimate for the microdebitage is $10,200 \pm 1100$ years, with a minimum age model of 4500 ± 600 years (and an over-dispersion of 56%). In the case study of Mushroom Rock West rockshelter, the OSL central age model estimate for microdebitage at 268 cm depth into the archaeological deposit is $21,200 \pm 3100$ years (with a minimum age model estimate of $10,500 \pm 5200$ years, and 60% over-dispersion), compared to a central age model estimate for the sedimentary quartz grains of $31,500 \pm 3100$ years (with a minimum age model estimate of $11,100 \pm 1500$ years, and 67% over-dispersion). For the archaeological layer situated at 441 cm depth, the microdebitage yielded an OSL age of $27,400 \pm 2200$ years. This sample of microdebitage produced the lowest over-dispersion (0.1%) on the palaeodose of any of the samples analysed, lending confidence to the accuracy of the palaeodose determination. The sedimentary quartz from the same sample produced an OSL minimum age model estimate of $33,500 \pm 5600$ years (and a central age model estimate of $46,900 \pm 3400$ years). Relationships between microdebitage and sediment OSL ages are discussed.

Direct OSL dating of the unheated quartz derived from the manufacture of lithic tools now provides an alternative to the reliance on sedimentary quartz as the primary source information regarding the age of archaeological deposits. This knowledge may be applied also to archaeological sediments previously excavated, for identifying episodes of lithic manufacture in temporal relation to other evidence of cultural activity. The ages of the two archaeological sites analysed differ widely, and this difference was also represented in the ages obtained from the microdebitage. None of the OSL age determinations of microdebitage was found to be unrealistically outside the boundaries of pre-existing age control.

This is one indication of the validity of the novel experimental approach applied.

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