
LUMINESCENCE DATING OF QUARTZ FROM IRONSTONES OF THE XINGU RIVER, EASTERN AMAZONIA

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ABSTRACT

Here we report the first investigation into the potential of quartz luminescence dating to establish formation ages of ferruginous duricrust deposits (ironstones) of the Xingu River in Eastern Amazonia, Brazil. The studied ironstones comprise sand and gravel cemented by goethite (FeO(OH)), occurring as sandstones and conglomerates in the riverbed of the Xingu River, a major tributary of the Amazon River. So far, the Xingu ironstones have uncertain formation ages and their sedimentary origin is still poorly understood. In this way, seven samples of ironstones distributed along the lower Xingu River were collected for optically stimulated luminescence (OSL) dating of their detrital quartz sand grains. The luminescence ages of the sand-sized quartz grains extracted from the ironstones were obtained from medium (100–300 grains) and small (10–20 grains) aliquots using the single aliquot regenerative-dose (SAR) protocol. Equivalent doses (D_e) distributions have varied overdispersion (OD) both for medium size aliquots (OD = 19-58%) and small size aliquots (OD = 29-76%). Samples with high overdispersion (> 40%) are attributed to mixing of grains trapped in different time periods by goethite cementation and/or to beta radiation dose heterogeneities to which the samples have been exposed during burial. Water saturated dose rates (dry sample dose rate) range from 2.70 ± 0.21 (2.79 ± 0.22) Gy/ka to 12.34 ± 0.97 (13.26 ± 1.12) Gy/ka, which are relatively high when compared to values reported for Brazilian sandy sediments elsewhere (~ 1 Gy/ka). The relatively high dose rates are attributed to the high concentration of U and Th in the goethite matrix. We observed the Th/U values greater than 4.0 that might indicate intense weathering in source areas or sedimentary recycling i.e., derivation from old sedimentary rocks. The obtained OSL ages for water saturated (dry) samples ranged from 3.4 ± 0.3 (3.2 ± 0.3) ka to 47.6 ± 4.8 (45.8 ± 4.7) ka, using D_e determined from medium size aliquots and dose response curves fitted by a single-exponential function. These late Pleistocene to Holocene ages suggest that ironstones of the Xingu River result from an active surface geochemical system able to precipitate goethite and cement fluvial sediments under transport. Our results also expand the application of luminescence dating to different sedimentary deposits.

Keywords: Fluvial sediments; Optically stimulated luminescence; Dosimetry; Geochronology.

