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Using OSL dating data for quartz provenance analysis in late Quaternary sediments of Amazonia

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Quartz grains are resistant minerals and abundant on Earth´s surface. They have been extensively used for optically stimulated luminescence (OSL) dating of Quaternary sediments from a large range of depositional environments. Recently, it has been demonstrated that the luminescence properties of the quartz can also be a useful tool for provenance analysis, because of the signal properties inherited from its parent rock, weathering conditions, and depositional history (i.e. cycles of erosion, transport, and deposition). These provenance studies are based on the OSL sensitivity (i.e. the light emitted per unit mass per radiation dose) of the first second of the luminesce signal of the quartz, using relatively fast and low-cost measurements. Since laboratories worldwide already have an extensive database with results of quartz signals primarily measured for dating studies, these data could potentially be repurposed for sensitivity analysis.

Here, we investigate the use of OSL quartz signals, originally measured for dating, for now characterizing the quartz OSL sensitivity and their usefulness for provenance analysis. The samples we studied are from Amazon fluvial systems: two Holocene endmembers from the Xingu and Solimões rivers, representatives of cratonic and Andean sediment sources, respectively, and a Pleistocene sample from Içá Formation, a paleo-fluvial system whose provenance is not fully known. First, we evaluate our approach by calculating the OSL quartz sensitivity of all quartz signals (i.e. signals derived from the natural, regenerative, and test doses) measured in a dating sequence with the Single Aliquot Regenerative dose (SAR) protocol. Such analysis gives the basis for deciding which signal, if any, should be prioritized for sensitivity calculation. Then, we compare the OSL sensitivities derived from quartz signals measured using the conventional sensitivity protocol with those measured by the conventional dating protocol. Finally, we deduce the sediment source of the Pleistocene Içá Formation based on the modern analogues (the Holocene endmembers).

Our preliminary results show that: it is feasible to use data from dating sequences for sensitivity calculation; OSL quartz signal derived from the natural test doses (L_n) is the best candidate for sensitivity calculation; the sensitivities provided by our approach are slightly larger than those

calculated using the conventional sensitivity protocol; and, the Pleistocene Içá Formation represents a mixed-source (Andean and Cratonic), which is different from the presumed modern analogue represented by the Solimões river, which is dominated by Andean sediments.