

Potential impacts of chemical weathering on feldspar luminescence – dating properties

Bartz et al.

General comments:

The authors have artificially weathered three feldspar mineral specimens (2 albite and 1 microcline) using oxalic acid and aqua regia for a month time. Luminescence characteristics of unweathered and weathered (at different time steps like 4, 10 and 30 days) grains were characterized. TL spectra, TL glow curve, IRSL decay curve, IRSL based dose response curve and fading rate were measured to check the change in the luminescence characteristics of these 3 feldspars. Very little change was observed in all the luminescence characteristics. The authors performed this study (artificial weathering) before they embark on the naturally weathered materials.

Although it is difficult to mimic the natural weathering process in laboratory, as is reflected in an unchanging luminescence characteristics, it is an important work. It is structured and presented in a way it can be understood and reproduced. However, I feel the sample selection is not proper because essentially 2 feldspar specimens were considered (albite and microcline) which under-represent the feldspar types. They could have considered 1) geochemical end members (orthoclase and anorthoclase in addition to albite), and 2) order-disorder representing feldspar (like sanidine in addition to microcline). I have some more comments and suggestions before it is accepted for publication.

Specific comments:

1. It is said that XRD measurements were done but the results are not shown. As XRD measurements have already been done, the order-disorder parameter could have been calculated and considered as another luminescence parameter. This parameter becomes relevant as the blue emission is hypothesized to be associated with an oxygen ion trapped in between 2 Al ions (Al-O^{1-} -Al). Hence monitoring this order-disorder parameter using XRD measurements with the time points will give better understanding.
2. In line with the earlier suggestion, change in the TL intensity and IRSL intensity before and after the artificial weathering i.e., the effect of weathering in controlling the residence time of trapped electron/hole is a direct and important luminescence dating characteristic. In simple terms whether weathering make a sediment younger than actual. This measurement demand that all the experiments should happen in dark environment. So, the reduction (or no change) in laboratory induced luminescence intensity before and after weathering will suffice (only 2 time points). For measurements shown in Figures 4 and 5, as I understood, laboratory irradiation was given after each time point.

Technical comments:

1. L.306-311. It is difficult to understand how Mn^{2+} is invoked to explain a small change in TL intensity (575 nm) with different weathering stage. Because this difference is explained away by the aliquot to aliquot variability in L. 219-223 referring to Fig. 5 and Figs. 3S.
2. L.315. Do you mean by U-340 filter, rather than the blue filter pack?
3. L.339. If this line is modified as “Although feldspar luminescence properties are assumed to be resistant to chemical weathering over Quaternary timescales, there are studies attributed weathering for the stratigraphically inconsistent ages.”

Thanks and regards, Morthekai | Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow, India.