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Extending the upper age limit for luminescence dating using the thermally transferred optically stimulated luminescence signal from quartz

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The optically stimulated luminescence (OSL) signal from quartz has been exploited for the last 20 years to date heated and unheated materials. While methods based on this signal have been extremely successful and are now widely adopted in laboratories around the world, growth of the signal with dose is affected by saturation and this commonly limits application to samples with equivalent doses of $\sim$100 to 300 Gy. In most environments this limits application of the method to the last 100-150 ka.

Studies of OSL from quartz in the late 1980's showed that if the OSL signal from a sample was reduced to background level by measurement, and the sample then heated, further optical stimulation gave a significant signal. This recuperated OSL was viewed as a problem to be avoided, particularly for young samples.

Three years ago papers were published showing that this recuperated signal has the potential to be valuable in dosimetry, and in particular that the signal continues to grow to doses in excess of 10,000 Gy offering the possibility of extending the age range over which quartz can be used to as much as 1 Ma. The first work on this signal was undertaken on fine grain quartz extracted from Chinese loess, and ages back to the Brunhes-Matuyama boundary were obtained. The signal is now commonly referred to as thermally transferred optically stimulated luminescence (TT-OSL). Intense research on the signal has focussed on a number of areas, including, (a) understanding the origin of the charge measured in TT-OSL, (b) improving methods for measuring the TT-OSL signal, and (c) developing protocols for using TT-OSL in dose estimation, and these are reviewed in this presentation.