Optically Stimulated Luminescence Analysis on the Modern Debris and Fluvial Deposits

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Abstract

Continuous technological development in luminescence dating techniques facilitates luminescence dating method to be applied widely to the sediments from various geomorphic settings, such as completely bleached sediments from aeolian and shore face environments or even partially bleached sediments from fluvial and debris environments. Burial ages since sediments exposed to the last daylight are supposed to be determined, and hence it can be applied to serve the research purpose of the paleoclimatology, paleoseismology and archaeology.

In Taiwan, frequently occurring earthquakes trigger numerous and serious landslides, which is the source of disastrous debris flow while unconsolidated landslide material accompanies heavy rain falls and typhoons. The rapidly deposited sediments are often found within the fluvial terraces, composed of boulders, cobbles and pebbles embedded with sandy matrix. However, burial ages of fluvial terraces are the major targets to study the neo-tectonic activity. Due to the short distances of transport, the probability of daylight bleaching is the major concern to the reliability of the luminescence dating.

Two individual sites of modern debris deposits in central Taiwan are selected for the luminescence analysis- (1) 5 samples (two from matrix, one from sandy layer and two from outwash channel) were collected from the middle reach of one of the tributaries of Chenyoulan River, (2) 3 samples (one each from matrix, fluvial sandy bar and outwash channel) were collected nearby the Ninety-Nine Peak.

Single-Aliquot Regeneration Protocol was adopted as the routine procedure. With an attempt to examine the best efficient way, the single aliquot and single grain methods were applied in extracting the well bleaching portion from debris deposits. Sediments from different debris facies were a separately determined. The present study explores the use of single grain luminescence studies in such poorly and heterogeneously bleached sediments. Our results reveal that the best way to deal with the debris materials is using single grain approach. In addition, the residual signals were smaller in the outwash samples than the matrix of the flow. It can be concluded that even a short distance of travel could still give better bleaching. The longer transported fluvial deposits facilitates the bleaching and increases the reliability of

luminescence dating method, especially for the young material, where the partially bleached component of luminescence is significant with respect to the luminescence acquired during deposition since burial.

References

張津瑞, 沈淑敏, 劉盈劭. 陳有蘭溪四個小流域崩塌與土石流發生頻率之研究. 師大地理研究報告, **34**, 63-83.

Ballarini, M., Wallinga, J., Wintle, A.G. and Bos, A.J.J. (2007) Analysis of equivalent dose distribution for single grains of quartz from modern deposits. (In press, *Quaternary Geochronology*).

Duller, G.A.T., Botter-Jensen, L., Murray, A.S., and Truscott, A.J. (1999) Single grain laser luminescence (SGLL) measurement using a novel automated reader. *Nuclear Instruments and Methods B*, **155**, 506-514.

Duller, G.A.T. (2007) Single grain optical dating of glacigenic deposits. (In press, *Quaternary Geochronology*).

Murray, A.S. and Wintle, A.G. (2000) Luminescence dating of quartz using an improved single-aliquot regenerative-dose protocol. *Radiation Measurements,* **32**, 57-73.

Olley, J.M., Caitcheon, G.G., and Roberts, R.G. (1999) The origin of dose distributions in fluvial sediments, and the prospect of dating single grains from fluvial deposits using optically stimulated luminescence, *Radiation Measurements*, **30**, 207-217.