



Evidencing syn-sedimentary volcanism in volcaniclastic series using coupled sedimentological and geochronological (U-Pb/zircon) analyses

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Volcaniclastic sediments, often under-studied, constitute an important part of the global sedimentary record, both in marine and continental environments. These sediments are of particular importance in order to constrain the age of sedimentation, particularly in series where interbedded lava flow are absent. Volcaniclastic sediments are also used in order to constrain the duration of the volcanic activity and to link volcanism with a specific geodynamic context. To demonstrate that volcanism and sedimentation were contemporaneous in a given basin, it is crucial to determine to which extent volcaniclasts present in the volcaniclastic sediments have been reworked. However, this determination is notoriously difficult.

As a case study, we characterized the Triassic volcaniclastic series from the Luang Prabang Basin, Laos, using coupled sedimentological and geochronological analyses. Sedimentological and petrographical analyses show a wide range of depositional environments (alluvial fan, braided river and alluvial plain) and evidence for reworking of the volcaniclastics in each of the corresponding deposits. U-Pb geochronology conducted on zircon grains extracted from the volcaniclastic samples of known stratigraphic position indicates that the maximum depositional ages get younger together with the sedimentary succession. This good correlation between absolute ages and stratigraphy demonstrates that, despite evidences of reworking, the volcaniclasts were produced, at least to some extent, contemporaneously with sedimentation. Then, in this specific example, the uncertainties obtained from the U-Pb ages can be used to indicate the 'reworking time scale', defined as the difference between the age of volcaniclast production and the depositional age of its host strata. Short reworking time scales, of ca. 1 Ma, one order of magnitude smaller than the total duration of the sedimentary record reveal that volcanism and sedimentation were contemporaneous. The use of coupled sedimentological and geochronological analyses may thus allow to determine the duration of volcanic activity even in the absence of volcanic deposits. Constraining the reworking time scales is useful to describe volcaniclastic deposits in which the volcaniclasts were reworked.