^{10}Be down-concentration profiles and high denudation rates: diagnostic criteria for identifying active deformation?

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Improving the identification and characterization of active deformations in low-seismicity regions is a difficult but necessary task to better address the seismological potential of slow active faults. In seismically active European regions, detecting active deformation that may lead to destructive earthquake requires innovative research methodologies that will supply basic data for more accurate seismic hazard assessments. Since the past decade, in situ produced cosmogenic nuclides revolutionize the study of landscape evolution. In particular, numerous studies have demonstrated that in active tectonic settings, cosmic ray exposure dating of deformed or displaced geomorphic features allows to quantify long-term deformation rates. However, in western European countries, the denudation processes due to climate setting and anthropism are probably the factors that mostly limit the accuracy of exposure ages and landscape modification rates. In this study, we present the results of a depth-profiling technique applied to alluvial terraces affected by the Moyenne Durance Fault (MDF), one of the major active faults in SE France. The expected decrease with depth of the measured ^{10}Be concentrations has been modeled using a khi-square fit based inversion method in order to constrain the exposure history of the alluvial sediments. The results suggest that the alluvial deposits located along the MDF can be regarded as rapidly eroding landforms in response to an active deformation due to the MDF. Our results suggest a vertical deformation rate on the order of 0.05 mm/yr. When compared to subsurface geophysical seismic profiles, our results would agree with a slip rate on the MDF slightly lower than 0.1 mm/yr, consistent with expected slip rates of individual faults located in SE-France.

Geochemistry and zircon ages of Variscan S-type granites from the western Bohemian Massif

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We present major and trace element data and U-Pb zircon systematics of the two largest exposures of S-type granite bodies from the southern Oberpfalz, Bavaria, in order to trace the compositional characteristics of the crust during the Variscan orogeny. Both granites (Neunburg, Oberviechtach) have similar mineralogical, geochemical, and Nd-Sr isotopic characteristics. They contain primary muscovite and cordierite and are characterized by peraluminous composition (A/CNK 1.2-1.3), high K_2O/Na_2O ratios (1.8-2.3), low initial $_{Nd}$-values (-8.2 to -6.2), and high initial $^{87}Sr/^{86}Sr$ ratios (0.7114-0.7147), consistent with typical S-type granites. They are distinguished from other Bavarian granites by their very low abundances in HREE's and highly fractionated REE composition (La_N/Yb_N ratios ~31-63 and Tb_N/Yb_N ratios ~3.4-3.8). Such "garnet-signature" was not jet been reported from other Bavarian granites. A likely possibility is that the garnet signature originated from partial melting within the garnet stability field.

Zircons from the two granites have been studied by the conventional U-Pb dating. The U/Pb isotopic systematics is far more complex than that of zircons from other studied areas and can not explained by simple crystallisation or lead loss mechanisms. Zircon grains with concordant ages around ~320 Ma are only present in some of the analysed fractions and indicate that the two granites probably intruded shortly after the regional HT-LP metamorphism of the Moldanubian basement. More than 70% of zircon grains of both granites contain inherited cores as shown by the cathodoluminescence (CL) images. Zircons with inherited cores cover an age spectrum ranging from early Proterozoic to early Palaeozoic, which suggests a chronologically heterogeneous source. The inner parts differ in size and morphology and consist of partly oscillatory zoned zircon. The U/Pb isotopic systematics and CL evidence point to melting of a source that comprised substantial metasedimentary components. Our data suggest that the Neunburg and Oberviechtach granites were formed by melting under relatively dry conditions and/or minimum melting temperature. Garnet signatures in S-type granites are expected in regions of thick crust and imply that high crustal thickness prevailed at the end of the Variscan orogeny in this region. Partial melting of dry granulitic lower crust seems to be an explanation for the derivation of the magmas.