U/Pb zircon ages on tuff in the Aflenz Basin (Styria/ Austria) – Evidence for Middle Miocene widespread volcanic deposits

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Deposits of Miocene volcanic eruptions are widespread all over Central-Eastern Europe. In Austria, occurrences of tuff are found in the Bohemian Massif as well as in the Styrian Basin. Occurrences of special interest have been described in the Fohnsdorf (Ingering Formation) and Lavanttal (Mühldorf Formation) extensional basins, which formed during eastward extrusion of the Eastern Alps. In the course of the mapping project GK102 Aflenz Kurort, a new volcaniclastic deposit has been discovered within the Sulzgraben Member. It is located in the southwestern part of the NE-SW-striking pull-apart Aflenz Basin. Within a 5 m thick detailed profile of different sedimentary layers, two layers of tuff were identified and sampled (WGS84 5262978N/516545E). They were partly rearranged during creep and soil flow processes. The lower part of the profile is built by 1.3 m thick ochre-grey white mica-rich clay and silt with angular local detritus (quartzite). It is followed by a conspicuous 20 cm thick layer with rounded altered greenish tuff components (SAMP1). To the top, the 90 cm of reworked tuff material is overlain by 1.3 m fresh white lapilli and biotite-rich tuff (SAMP2+3) with plant fossils of leaves. The top part of the profile is formed by 30 cm weathered tuff, 30 cm grey-brown clay with plant fossils and detrital white mica and 70 cm of well-rounded silt-sand-gravel with concretions and plant remains. The top tuff shows a mineral assemblage of quartz, feldspar, biotite, glass shards. In thin section, the tuff has a fine-grained matrix with xenocrysts of feldspar and biotite as well as accessory apatite and zircon. A special feature are accretionary lapilli with a dimension up to 2.5 mm, which are characteristic for aerial transported volcanic ash. Bulk rock geochemistry of three tuff samples from the top parts yields a rhyolitic composition with a high silica content of 75 % and a low sodic and potassium content. They show consistent chondrite normalized trace element patterns characterized by slightly decreasing LREE concentrations, a marked Eu anomaly (EuN/Eu*: 0.34–0.39) and almost flat HREE. In addition, high Ba (> 1,000 ppm) and Zr (> 100 ppm) as well as Hf concentrations higher than 3.5 ppm are observed. Zircons were separated from three samples collected along an upright profile and dated with U-Pb LAMCICPMS. The lower greenish tuff in the substratum part (SAMP1) yielded an age of 14.7 ± 0.1 Ma. The two samples of the white pure upper tuff (SAMP2+3) yielded ages around 14.1 ± 0.2 Ma. These age data in combination with geochemistry suggest an ash source from the Tibolddaróc (U-Pb LAICPMS zircon age: 14.7 ± 0.2 Ma) and Harsány (U-Pb LA-ICPMS zircon age: 14.3 ± 0.2 Ma, EuN/Eu*: 0.3–0.4) volcanic events in the Bükkalja Volcanic Field (Hungary) for the lower and upper tuff, respectively. They also provide evidence for widespread volcaniclastic deposits from these sources up to Austria.