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A multi-proxy record from the Quaternary Vienna Basin: Chronology, climate and environmental change at the Alpine-Carpathian transition during the last 250,000 years

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Dated multi-proxy records of terrestrial sequences in the Quaternary of the circum-Alpine realm are sparse. This is especially true for those exceeding the time span of the last glacial maximum as extensive glaciers eroded substantial parts of potential records. Outside formerly glaciated regions, preservation space is low in the absence of tectonic subsidence. Foreland terraces forming as a consequence of mountain range uplift may partly account for this gap but are typically dominated by coarse-grained fluvial sediments commonly reflecting only short pulses during cold stage periods. Here we analyze a terrestrial record in the Vienna Basin in order to derive regional climatic and environmental changes of the last c. 250 ka. The Vienna Basin forms as a classical pull-apart feature showing a length of almost 200 km and a width of c. 55 km. Quaternary subsidence is focused along the active Vienna Basin Transfer Fault leading to the formation of a series of narrow strike-slip (sub-) basins and grabens with the Mitterndorf sub-basin being the largest (c. 270 km^2) and deepest (c.175 m). The southern part of the basin is confined by the alpine mountain front and fed by two alluvial fans highlighting up to several tens of meters thick coarse grained, massive sediments intercalated by up to few meters thick fine clastic sediments.
We investigated the fan's sequence development through core and outcrop sampling applying luminescence dating, magnetostratigraphy, soil and lithofacies classification as well as malacological analysis. The latter comprise the determination and distribution of species and individuals as well as coenological analysis. Data suggest a distinct sequence development with coarse-grained massive sediments abundantly deposited during cold periods (MIS 2 and 6) and fine, overbank sediments and soils, dominantly forming during warmer, Interstadial or Interglacial periods (MIS 5 and 7). Overbanks and soils are generally rich in terrestrial mollusk assemblages giving us the opportunity to reconstruct changes to the paleoenvironment, well compensating for the typically lack of pollen in such environments. For example high species diversity in land-snail assemblages associated with a large quantity of xeric individuals in overbank fines point to narrow riparian habitats along distinct streams. They are limited by dry grasslands were soil forming processes dominate. This is in accordance with the lithofacies data suggesting changes to the river style and transport mode but is also in accordance with the Holocene record. Compared to modern data, land-snails assemblages suggest that the mean annual precipitation was generally lower during most of the covered time period. Similar is true for the estimated mean annual temperature: Only during the late MIS7, malacological data suggests temperatures which may have been slightly higher than today. To our knowledge, the provided chronologies of the land-snail successions do also reflect the first absolute age constraints from assemblages clearly older than the LGM.