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The pre-orogenic detrital zircon record of the Variscan orogeny: Preliminary results

Tobias Stephan and Uwe Kroner
Geologisches Institut, TU Bergakademie Freiberg, Germany (tobias.stephan@geo.tu-freiberg.de)

To test plate-tectonic constellations in consideration of the long-term development of sedimentary transport paths, temporally and spatially highly resolved records of provenance analysis are mandatory. The interpretation of existing studies focus on small-scale areas within an orogen thereby neglecting the differing distribution of provenance data in the entire orogenic system. This study reviews a large data set of compiled geochronological data to document the development of pre-orogenic tectonic units on the example of the Variscan orogeny. Constrained by tectonic and geological models, the temporal distribution of U-Pb detrital zircon ages, used as a proxy for sedimentary provenance, shows that some minima and maxima of zircon abundance are nearly synchronous for thousands of kilometres along the orogeny.

Age spectra of Precambrian to Lower Palaeozoic samples were constructed on the basis of 38729 U-Pb ages from 685 samples that were compiled from 102 publications. The age compilation combines thermal ionization mass spectrometry (TIMS), laser ablation-inductively coupled plasma-mass spectrometer (LA-ICP-MS), sensitive high-resolution ion microprobe (SHRIMP), and secondary ion mass spectrometry (SIMS) analyses. The data was re-processed using a common age calculation and concordance filter to ensure comparability. The concordance of each zircon grain was calculated from 206Pb/238U and 207Pb/235U ages to guarantee that only concordant grains, i.e. with <10% normal and <5% reverse discordance, were included in the age compilation. In order to ignore a metamorphic overprint and hence a blur of the younger age spectra, the compilation is constrained to age data older than 400 Ma only. If a precise sample age is not documented by the author, the weighted-mean age of the youngest zircon population (n > 3) is used for the maximum age of deposition. In addition to the location of >600 samples, the precise depositional ages result in a spatially and temporally high resolution. To avoid the different levels of analytical precision of the compiled TIMS, LA-ICP-MS, SHRIMP, and SIMS data, detrital zircon ages are plotted as kernel density estimates. Spatial and temporal distribution of the kernel density estimates, as well as further statistical techniques (e.g. multidimensional scaling) are used to discriminate groups of similar age distributions. Preliminary results reveal four major sources for the pre-orogenic sedimentary units (i.e. Saharan Metacraton, West-African craton, Amazonas craton and Fennoscandian shield). The mixing of several source signals in Gondwana derived sediment spectra point to vast deltaic systems along the Gondwanan shelf area.