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Provenance analysis of Paleoproterozoic siliciclastic sedimentary rocks of the Fennoscandian Shield

Claudia Gärtner (1), Heinrich Bahlburg (1), Axel Gerdes (2), Kornelia Scholonek (1), Barbara Huber (1), and Jasper Berndt (3)

(1) Institut für Geologie und Paläontologie, Westfälische Wilhelms-Universität Münster, Germany (claudiagaertner@uni-muenster.de), (2) Institut für Geowissenschaften, Goethe-Universität Frankfurt, Germany, (3) Institut für Mineralogie, Westfälische Wilhelms-Universität Münster, Germany

Detrital zircon geochronology is an important tool to investigate the provenance of siliciclastic sediments. We present detrital zircon U-Pb geochronological results combined with Hf isotope and whole rock geochemical data from Paleoproterozoic siliciclastic sediments from the Pechenga and Imandra-Varzuga greenstone belts of Fennoscandia to determine source rocks and provenance areas of the detrital zircons and sedimentary rocks. Furthermore, the light and heavy mineral composition was analysed to further constrain sources of the detritus deposited in the Paleoproterozoic basins. Detrital zircon geochronological analysis obtained ages from 3700 Ma up to c. 1900 Ma with an age range between 2900 and 2600 Ma dominating in most samples. This interval coincides with a period of crustal growth in Fennoscandia during accumulation of the supercontinent Kenorland and suggests zircon derivation from cratonic areas and the Archean Fennoscandia basement. Zircons with ages $<$2600 Ma represent the onset of rifting that led to the later break up of Kenorland. 2400-2100 Ma aged zircons represent a period of orogenic quiescence, whereas younger zircons represent the time of the Kenorland break up until 2000 Ma. Afterwards, new accretion of Neoarchean microcontinents to Fennoscandia followed during the Archean-Paleoproterozoic transition until 1900 Ma, reflected by the youngest detrital zircon ages. Hf isotope analyses on Archean-aged zircon grains yielded juvenile εHf values, showing an evolution to slightly negative εHf values with decreasing age. This indicates a juvenile origin and partly reworking during subsequent orogeneses and accretion processes. Ages $<$2100 Ma represent two groups of different origins and provenance. One is characterized by evolved isotopic values (-9 to -4) suggesting reworked sources, the other has juvenile εHf values of -5 to +6 which point to an additional involvement of new crustal material around 2000 Ma. Heavy mineral populations consist mainly of stable mineral assemblages of rutile, tourmaline and zircon suggesting significant sedimentary reworking of upper crustal source areas. This is also reflected by light mineral compositions pointing to exhumed crustal blocks. Tourmaline geochemical compositions indicate sources of felsic origin. Amphiboles reflect derivation from contact metamorphic rocks. REE distributions with enriched LREE and depleted HREE abundances mainly indicate Archean sources for the sampled sedimentary rocks. In some samples, pivotal element ratios, e.g. Th/Sc or negative Eu-anomalies, in turn point to Paleoproterozoic sources. This coincides with the varying age groups in the detrital zircon spectra, containing both Archean and Paleoproterozoic ages. These new results narrow down the provenance areas for the Archean detrital zircons to the surrounding cratonic domains like the Kola and Karelian provinces, as well as the Murmansk and Belomorian provinces. Paleoproterozoic zircons derive from newly accreted microcontinents, like the Umba Granulite Belt, Strelna Domain, Inari and Tersk terranes, juvenile arcs, and/or the Lapland-Kola orogen and were deposited concomitant to the Svecofennian orogeny.