Transportation and diagenetic controls in the formation of Lower Cambrian quartz arenite on Baltica

LORENTZEN, SANNE[1*], AUGUSTSSON, CARITA[1], JAHREN, JENS[2], NYSTUEN, JOHAN P.[2], BERNDT, JASPER[3], SCHOVSBO, NIELS H.[4]

[1]Department of Petroleum Engineering, University of Stavanger, Norway [*correspondence: sanne.lorentzen@uis.no; carita.augustsson@uis.no]

[2]Department of Geoscience, University of Oslo, Norway [jens.jahren@geo.uio.no; j.p.nystuen@geo.uio.no]

[3]Institut für Mineralogie, Münster University, Corrensstrasse 24, Germany [jberndt@uni-muenster.de]

[4] Geological survey of Denmark and Greenland, Denmark [nsc@geus.dk]

Quartz arenite of Early Cambrian age is a world-wide phenomenon. Reworking and diagenetic processes are, however, rarely taken into account in order to explain their origin. We study quartz-arenitic deposits related to the incipient stage of the Early Cambrian transgression on Baltica from a combined diagenetic, provenance and sedimentary perspective. U-Pb-dating of detrital zircon of the quartz arenite show dominating ages of 1.6–1.8 Ga and 0.9-1.3 Ga, with local variations. The ages are in accordance with transport from the Transscandinavian Igneous Belt and the Sveconorwegian Orogen, indicating a short transport distance on the given peneplain setting. Quartz arenite from Southern Norway has an intergranular volume of ca. 20% with almost 100% of the initial porosity being replaced by quartz cement. Authigenic minerals and detrital phyllosilicates represent only 5% of the present-day composition in most samples. This indicates that the sand was extremely quartz-rich already at deposition, formed during CO_2-driven chemical weathering of granitic bedrock over very long time intervals. Reworking by waves and subsequent removal of early authigenic components formed by fresh-water flushing and alteration of feldspar is believed to severely have influence the composition. The sand grains of the arenites are interpreted to represent first-cycle deposits. Nearly 50 meters of continuously cross-bedded and rippled medium-coarse sand suggest a relatively stable shallow marine environment. These geometries may have resulted from landward-directed high-energy wave activity and reworking of marine sand deposits during long periods of little sediment supply from land. Time is the critical factor in formation of Early Cambrian quartz-arenites, including weathering, flushing and reworking processes.