To What Extent Are the Favorable Reservoir Properties of the Jurassic of the Southwest Barents Shelf Controlled by Sedimentary Provenance?

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ABSTRACT

Jurassic siliciclastic units on the southwest Barents Shelf represent major targets for exploration. Favourable reservoir properties are present in the Early to Middle Jurassic Tubåen, Nordmela and Stø formations where numerous discoveries have been made. However, despite being extensive, the Jurassic is generally thin and has an uneven distribution on the southwest Barents Shelf. A pronounced increase in sediment maturity is associated with the Jurassic units. This may have resulted from changes in climate, depositional environment and diagenesis. However, it is accompanied by an increase in sedimentary rock fragments and a marked shift in detrital zircon age patterns, which suggests a change in provenance. Deposition probably therefore coincided with an episode of drainage reorganisation, during which the contribution of sand from the Uralian Orogen waned following rejuvenation of sediment source regions in northern Norway and Svalbard. The cause and pace of the provenance change is debated, at least in part because significant sedimentary reworking is suspected and the resultant zircon patterns are largely inherited from the successions eroded in the source region, obscuring sediment routing. To further investigate the source(s) of the Jurassic units, the results of a variety of provenance techniques (petrography, heavy mineral analysis, combined U-Pb geochronology and geochemistry of rutile and Pb isotopic compositions of K-feldspar) are presented to complement the detrital zircon U-Pb ages. The results reveal that the majority of the detrital zircons were indeed reworked. In southern areas, Jurassic sandstones with a Fennoscandian Shield and Caledonian Orogen provenance can be clearly delineated. In northern areas, Triassic units, originally sourced from the Arctic Uralides, were reworked. The location of this source region is elusive. Candidates include local and periodically emergent highs or Svalbard, possibly mixed with persistent first cycle sand from the Arctic Uralides. The multi-analytical approach employed sees through the obscuring effects of sediment recycling and provides provenance information which may otherwise be missed using zircon analysis alone. The results reveal sandstones sourced from the Fennoscandian Shield retain the best porosities and form the most favourable reservoirs. This provides improved constraints on Jurassic sediment routing and thus also on the location and properties of potential sandstone reservoirs.