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# Clustering and interpretation of local earthquake tomography models in the southern Dead Sea basin

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The Dead Sea transform (DST) marks the boundary between the Arabian and the African plates. Ongoing left-lateral relative plate motion and strike-slip deformation started in the Early Miocene (20 MA) and produced a total shift of 107 km until presence. The Dead Sea basin (DSB) located in the central part of the DST is one of the largest pull-apart basins in the world. It was formed from step-over of different fault strands at a major segment boundary of the transform fault system. The basin development was accompanied by deposition of clastics and evaporites and subsequent salt diapirism. Ongoing deformation within the basin and activity of the boundary faults are indicated by increased seismicity.

The internal architecture of the DSB and the crustal structure around the DST were subject of several large scientific projects carried out since 2000. Here we report on a local earthquake tomography study from the southern DSB. In 2006-2008, a dense seismic network consisting of 65 stations was operated for 18 months in the southern part of the DSB and surrounding regions. Altogether 530 well-constrained seismic events with 13,970 P- and 12,760 S-wave arrival times were used for a travel time inversion for Vp, Vp/Vs velocity structure and seismicity distribution. The work flow included 1D inversion, 2.5D and 3D tomography, and resolution analysis.

We demonstrate a possible strategy how several tomographic models such as Vp, Vs and Vp/Vs can be integrated for a combined lithological interpretation. We analyzed the tomographic models derived by 2.5D inversion using neural network clustering techniques. The method allows us to identify major lithologies by their petrophysical signatures. Remapping the clusters into the subsurface reveals the distribution of basin sediments, prebasin sedimentary rocks, and crystalline basement. The DSB shows an asymmetric structure with thickness variation from 5 km in the west to 13 km in the east. Most importantly, a well-defined body under the eastern part of the basin down to 18 km depth was identified by the algorithm. Considering its geometry and petrophysical signature, this unit is interpreted as prebasin sediments and not as crystalline basement. The seismicity distribution supports our results, where events are concentrated along boundaries of the basin and the deep prebasin sedimentary body.