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QUANTIFICATION OF PERMEABILITY VARIATIONS ACROSS THIN LAMINAE IN CROSS BEDDED SANDSTONE

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Abstract An automated precision probe permeameter has been used to investigate the influence on the flow properties of thin laminae in cross bedded sandstone. The material analysed is characterized by lamination, some easily visible and shown to have high permeability contrasts between laminae, but also more subtle lamination in material appearing virtually massive.

Because of the unconfined flowgeometry of the probe permeameter, the permeability of low-permeable laminae thinner than the diameter of the probe tip-seal will be overestimated. This is shown by having cubes cut parallel to the laminae. The permeability in three orthogonal directions have been measured conventionally in a core-holder and compared to probe permeameter measurements on the sides of the cubes. This method has also demonstrated and quantified permeability anisotropy on a scale smaller than the dimensions of the probe.

Probe measurements on plugs show that horizontal (Kh) and vertical (Kv) conventional plug permeabilities may give reliable information about the higher contrast lamination. With lower contrast lamination, local variations in permeability shown by the probe permeameter to exist even in visually very homogeneous material, make conclusions drawn from Kv and Kh more uncertain.

The results from the small-scale measurements have been combined with probe measurements on a 7 m interval of tabular crossbedded sandstone to estimate a probable permeability interval for the unit. Comparison of the permeability estimated from the core data with well test permeability shows reasonable agreement.