Microseismic source mechanisms associated to geological structures for a better understanding of deep brine production

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Arkema produces brine in southern France by solution-mining a salt formation at a great depth ranging from 1,900 m to 3,000 m. This salt formation is part of a complex geological formation. Associated salt leaching induces an important microseismic activity, recorded by two downhole sensors.

Most of the time, microseismic study only provides a 3-D location of the seismicity. When few sensors are available, the computation of the focal mechanism of microseismic events is not performed and no information related to the geometry of the source is given. Only correlations with production pressure has already confirmed the formation response associated with microseismic activity.

A new method allows us to compute focal mechanism using only two downhole 3-axis sensors. The focal mechanism and correct additional parameters, such as source radius, enable determining the direction of the mechanism and the associated geological structure.

This paper presents the results of a case study on microseismic events induced by leaching on a pair of wells for 4 years. The computed source mechanism provides additional information on formation behaviour induced by brine production and underlines the different geological structures acting as fluid path.

Correlated with different production steps, the source behaviour is then associated with the occurrence of the seismicity along an important identified thrust fault and with the reactivation of a well-known listric faults.