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Oblique reflections in Dogger aquifer below GGR5 well.

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Abstract.

The dipole sonic scanner tool run in the subhorizontal geothermal (SH) well of Grigny GGR5 in April 2023 provided interesting images of a reflector population oblique to the main bedding and attributed to oolite progradation located in a depth interval from 4 to 7m below the SH drain, without intersecting the borehole [Naville et al. (*in press*)]

The prograding oblique reflections have been detected with a 7-15° Dip, towards an azimuth outside the near vertical plane containing the SH drain and orthogonal to the subhorizontal bedding of the carbonate Dogger aquifer, thanks to the automated sonic imaging (ASI) processing of the 8 azimuthal sensors located on each of the 13 receiver levels of the oriented array dipole sonic tool.

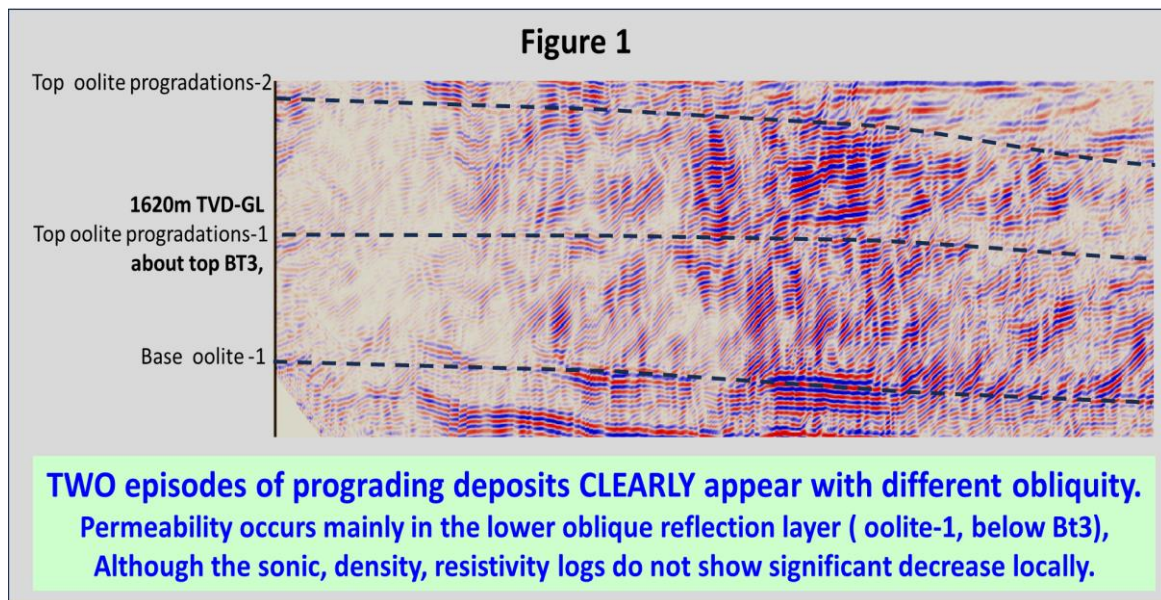
In February 2024, Schlumberger successfully improved the image of all dipole sonic reflectors in the SH well vicinity, up to a radial distance of 30-35m to the SH drain, with sharper reflector definition, reduced artefacts and more accurate coherency of all reflectors, either bedding reflectors subparallel to the SH drain, or oblique reflectors. What might have previously appeared as reflection “noise” to the interpreter is now attributed to a continuous succession of oblique reflectors located all along and below the 800m long horizontal extension of the SH drain. Details of this improved dipole sonic data processing method are exposed in [Hirabayashi et al. (*in press*)]

The main bedding reflections, such as the top of Dogger carbonates, show an improved lateral coherency on the new S-S dipole sonic cross-sections. Moreover, the improved oblique reflection images exhibit various dip of the oblique reflectors, and two superposed layers of oblique reflections with different dips, located slightly above the bottom of the pilot hole (Fig.1).

The proposed presentation includes a tentative description of the expected geological bodies observed, as the processing engineers of the array sonic data confirm the reliable capabilities of their imaging routines to reach detailed structural features (dip, azimuth, lateral image coherency, etc..) useful to geological description.

Refined local study of the detailed local stratigraphy the geological bodies observed in the Grigny GGR5 vicinity might be potentially motivated, through a collaboration of industrial engineers with academic researchers.

Curiously, the detailed sonic sections do not show any fault with metric throw similar to the ones present on the VSP image right below the deviated section of the GGR5 well, 150m laterally to the SW of the GGR5 pilot hole.



References:

Naville, C., Jeroen Jocker J., Dahlhaus L., Kumar R., Wielemaker E., Hamon Y., Ungemach P., Antics M., Sarda D., Souque C., Vincent B. : Imaging the vicinity of a subhorizontal (SH) drain into the carbonate Dogger geothermal aquifer using the 3D Far Field (3DFF) processing of a dipole sonic array dataset; results and perspectives, SPWLA 2023 Fall Topical Conference "SEE AND HEAR THE FORMATION: EXPLORING THE SYNERGIES BETWEEN BOREHOLE IMAGING AND BOREHOLE ACOUSTICS"/ LOOKING BEYOND THE WELLBORE, November 8-9th 2023, Houston, TX, online: <https://www.researchgate.net/publication/377983629> Imaging the vicinity of a subhorizontal S H drain into the carbonate Dogger geothermal aquifer using the 3D Far Field 3DFF processing of a dipole sonic array dataset results and perspectives

Hirabayashi, N., Dahlhaus, L., Kumar, R., Jocker, J., Wielemaker, E., Khaitan, M. L., and Naville, C.: Analysis of geologic structures using deep sonic imaging, SEG/AAPG IMAGE'24 event, International Meeting for Applied Geoscience & Energy Expanded Abstracts, available online: https://www.imageevent.org/technical-program-/full-schedule?_cldee=edPefOiNtdAhLUzlsS16DQ--ZLWHhLoABO8fdnMGAhzSO0QgAYzGspwplPrAcBrw&esid=b426ff3f-c949-ef11-a316-0022481c45c3&recipientid=contact-5fe7296e186a4b709d7ff6c32df3fd71-cae9144b03f048adb72cc365be62e20c (presented on Wednesday August 28th at 2 :35pm / session BH 3: Advances in Sonic and DAS VSP Imaging).