Joint network distribution and significance in the Variscan series of the northern margin of the Zag Basin (Anti-Atlas, Morocco)

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We present here an overview of the regional distribution of fracture networks (s.l) in the Paleozoic substratum of the Anti-Atlas Variscan domain north of the Zag Basin. The Cambrian to Devonian series present excellent outcrops of large cylindrical, conical or asymmetrical folds, most often without penetrative cleavage or metamorphism. In this folded domain, six consistent trends of joints sets (F hereafter) are defined: F1 (N150-N160), F2 (N50-N70), F3 (N120-N130), F4 (N25-N40), F5 (N80-N100) and F6 (N10-N170). The master joints are orthogonal or nearly orthogonal Axial and Transverse (A/T), and the secondary ones are oblique ones in general in conjugate attitude (O_1/O_2) to previous ones. Most of folds contain at least two sets of orthogonal joints: A/T and O_1/O_2 with frequent (typical) mutual substitution from master to oblique among the above defined directions. The well represented master network A/T follows the large scale arched distribution of fold direction, determined by the Western, Central and, Eastern Anti-Atlas. They can be essentially related to the outer arc of hinge extension. While T-joints, that represent the trajectory of the main Variscan shortening directions, form roughly a large fan diverging from Zag basin. The secondary networks (O) joint sets, oblique to folding axis, are always present in the folds depending on the fold orientation and localisation. The genetic origin of such oblique sets is controversial. We present an interpretation taking into account observations on the influence of fold geometrical interferences, folding episodes superposition and a superimposed post-Variscan fracturing event. At the top of the Jbel Ouarkziz monocline carboniferous, there is an attenuation of jointing away (in space and time) of the fold related shortening. This study will permit anticipation of joint distribution of folded buried reservoirs under the northern margins of the Zag and anti-atlasic basins (Souss, Ouarzazate and Tarfaya).