

Reappraisal of the deep Devonian strata under the Mons Basin

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Abstract

To investigate the deep geothermal potential of Hainaut, the Saint-Ghislain borehole and more specifically its deepest section (depth -4393 to -5403 m) is the main, if not the only, local source of information. The only available descriptions and interpretations about the deepest 1000 m of this borehole, drilled between 1973 and 1978, are a brief overview published by Groessens et al. (1979) and the detailed description by Legrand of the few meters of cored material, sampled between -5.000 and -5.260 m, in the Geological Survey archives. During the drilling operations, cuttings were sampled nearly every meter along this section. The samples have been stored at the Geological Survey. This work consists of extracting the maximum information on the deep Devonian formations concealed under the Carboniferous rocks and the Meso-Cenozoic Mons Basin, by means of a thorough examination of the cuttings and other related information.

The 850 available cutting samples (a 78 m long section could not be retrieved) were studied by stereomicroscopy. Based on these observations the main rock type proportions (shales, siltites, carbonates ...) were estimated, providing a rough lithologic section. Complementary analyses were performed to try to corroborate the results. Particularly, palynological content was studied on the deep cored intervals and some selected cutting samples. Magnetic susceptibility and X-ray diffraction were also performed. The integration of archive data such as calcimetry and relevant information from drilling operator reports complemented our new results. The upper section of the investigated interval is mainly composed of green siltites, while the middle section is dominated by carbonates, while the lower section consists of mixed shale and carbonate. Legrand interpreted the latter as Frasnian based on the macrofaunal content, which is similar in Tournai and Vieux-Leuze boreholes. Our work provides new geochronological constraints of the two lowest core samples through palynomorph analysis, which suggests an Upper Givetian – Lower Frasnian transitional age.

As a conclusion, we propose a new lithostratigraphical interpretation of the lowest part of the Saint-Ghislain borehole. The Famennian, with its top at -4300 m (according to Delmer, 1977), appears to be quite thick and its base might lie at about -4800 m. The underlying calcareous shales can be considered as Upper Frasnian in age. Finally, the lowest formations, between -5100 m and the bottom of the borehole at -5406 m, is interpreted as Lower Frasnian, and possibly the uppermost Givetian is also present. These results open new insights for palaeogeographical and structural interpretation of the deep geology under the Mons Basin.