New stratigraphic interpretation of the twenty-eight-year old GPK-1 geothermal well of Soultz-sous-Forêts(Upper Rhine Graben, France).

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The Upper Rhine Graben (URG) is characterized by a series of positive thermal anomalies.In Northern Alsace, the Soultz-sous-Forêts pilot project for power production (1987) has been followed recently by an industrial project in Rittershoffen for a geothermal application. Both sites have been explored by deep drilling operations aiming to exploit the heat extracted from a deep Paleozoic basement covered by a sedimentary sequence. Deep wells reached the granite basement respectively at about 1400 mand 2150 mdepth.

As the doublet of Rittershoffen (GRT-1, Fig. 1 and GRT-2, Fig.2) has a very detailed and complete stratigraphic log without major faults and discontinuities (Duringer, 2014;Duringer et Orciani, 2015), it has been used as a geological baselinein order to reinterpret GPK-1borehole, poorly investigated in its sedimentary part.

The main goal of this work is todetermine the accurate depth of top and base of each lithostratigraphic unit and to highlight their thicknessvariations between Soultz and Rittershoffen, located 6 km east (Aichholzer, 2015). Gamma ray logs were used for interpreting the lithostratigraphicunit correlations between those wells (Fig. 1).

Compared to the very complete and well-documented lithological log of Rittershoffen, one of the first results is the substantial reduction of Tertiary and Quaternary formations. It lacks the whole "SériesGrises" and upper part of the "Couches de Pechelbronn" (both from Oligocene) and almost the total "Plio-Quaternary" formations, which all representa cumulated thickness of almost 600 m (Fig.2).

A second great difference is situated at the Mesozoic/Cenozoic discontinuity: the erosion on the upper part of the Jurassic is much higher in the Soultz's column and therefore several units of the Dogger are absent (removed during the Cretaceous/early Tertiary emersion). Compared to GRT-1and GRT-2 (Rittershoffen), it lacks around 63 mof Jurassic formations in GPK-1 well (Fig. 2).

Lastly, we highlighted the occurrence of two normal faults which are affecting the Lias and the Muschelkalk units. The fault in the Lias led to the disappearance of the major part of the “Marnesà Ovoïdes” formation (it rangesfrom 49 m to 17 m). The fault in the Muschelkalk removed the complete “MarnesBariolées” and the lower part of the “Dolomie à Lingules” formations. Both faultdisplacements reduced the Mesozoic part of around 76 m thick (Fig. 2).

If we sum what is lacking in the Tertiary/Quaternary (Quaternary erosion), in the upper Jurassic (“pre and early Cenozoic erosion”) and what has disappeared due to the vertical fault off-sets (one in the Jurassic and one in the Muschelkalk), the stratigraphic column of Soultz-sous-Forêts (GPK-1), compared to that of Rittershoffen (GRT-1 and GRT-2), is reduced of around 740 m(Fig. 2).

Thus, detailed lithostratigraphic unit analysis calibrated on those geothermal wellsis a very powerful technique for improving the geological knowledge such as 2D seismic profile in this part of the Upper Rhine Graben which is very attractive in terms of geothermal project development.

Acknowledgements

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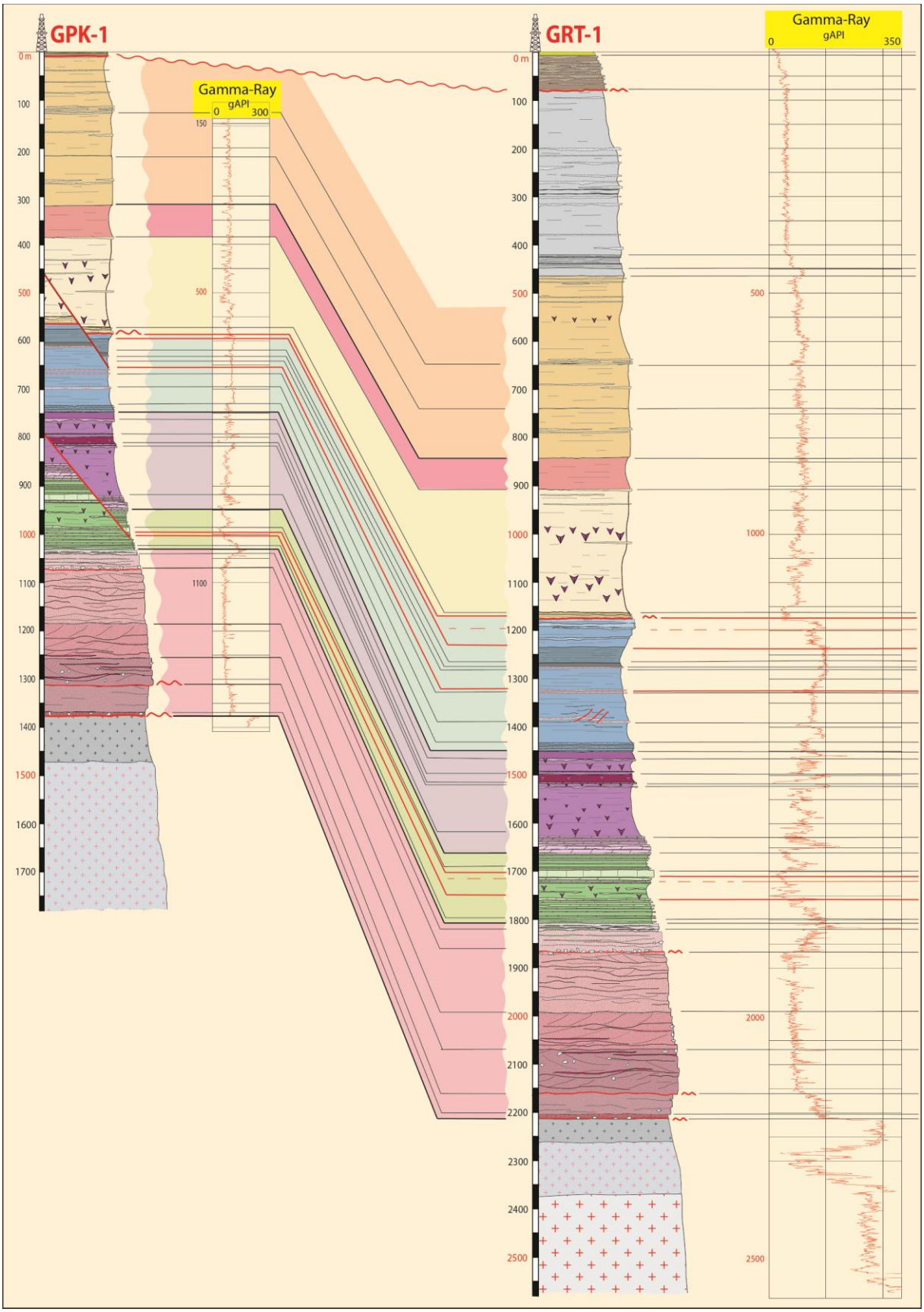

Figure 1.Lateral stratigraphic correlations, based on Gamma Ray logs,between GPK-1 and GRT-1 wells(After Aichholzer, 2015). Original data from GRT-1 are adapted from Duringer (2014).

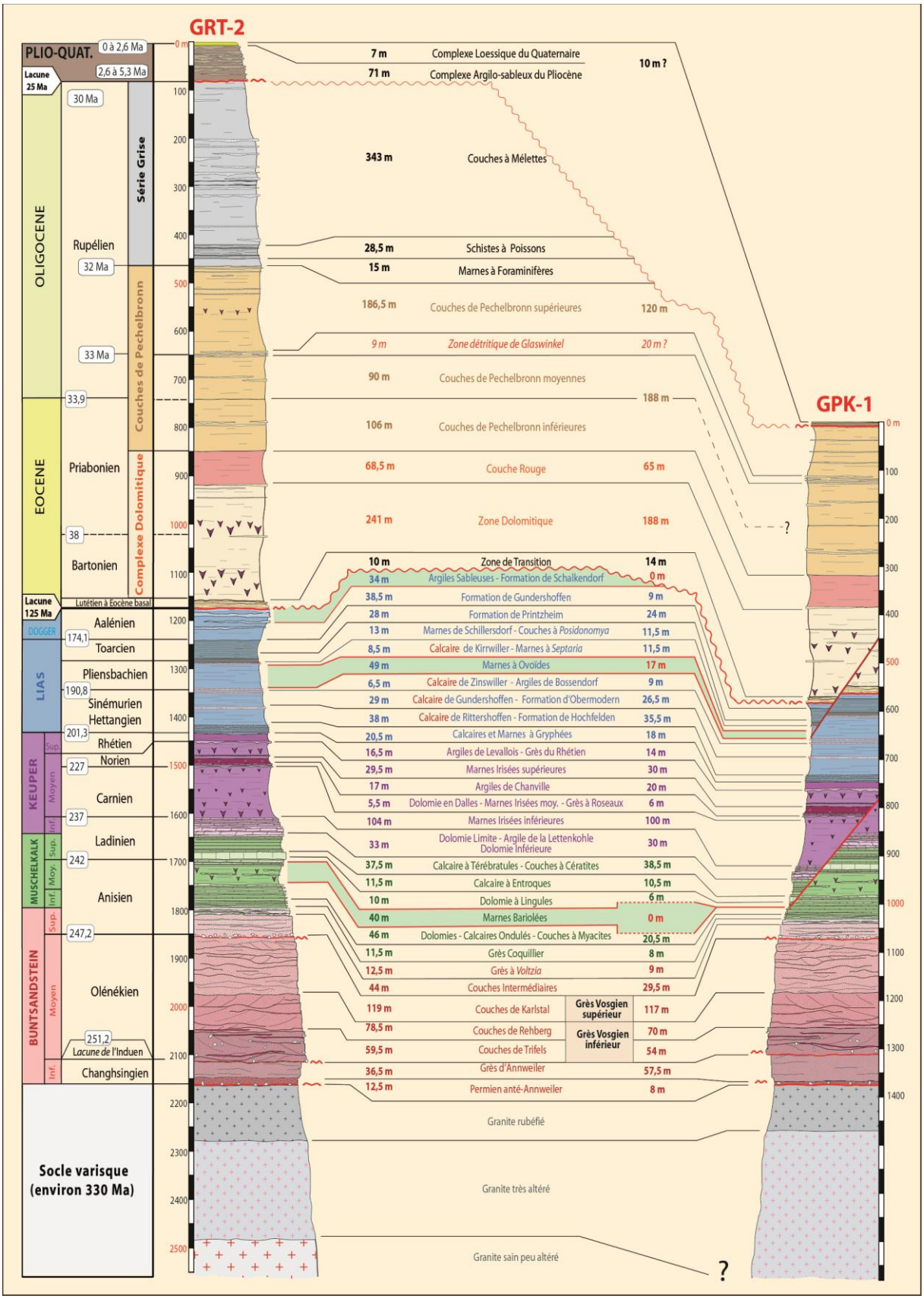

Figure2. Stratigraphic correlations and comparisons between GRT-2 and GPK-1 wells (After Aichholzer 2015).Original data of GRT-2 are adapted from DuringerandOrciani(2015).