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HYDRAULIC AND BRITTLE EXTENSIONAL FAULTING IN THE WEALDEN FACIES OF HAUTRAGE (MONS BASIN, BELGIUM)

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(3 figures)

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In Belgium, the Wealden facies are mainly localised on the north edge of the Mons Basin, where they appear in pluri-kilometric sized "pockets". The Hautrage Clay Formation, middle Barremian to earliest Aptian in age (Yans, 2003), is composed of continental clays, silts and sands, containing lignite remains, pyrite and siderite nodules in variable proportions. The depositional environment of Hautrage is currently interpreted as a floodplain traversed by numerous channels (Yans et al., 2002; Yans, 2003), even if the swamp or lacustrine environment hypothesis is not completely rejected (Spagna, *in progress*).

The interest of this study lies in the fact that the hydraulic and brittle deformation affecting the oldest Cretaceous sediments occurring in the Mons Basin, could be observed, providing information on the geodynamical context during the early phase of the basin formation. Up to now, little was known about the tectonic history of these sediments, mainly because of the lack of good outcrops.

Due to recent excavating campaigns in the Hautrage clay pit, an interesting outcrop (fig. 1.B) composed of a multi-faulted channel complex has been revealed (fig. 1.A and 1.B represent two outcrops crossing the same structure, the outcrop "B" being localised around 25 meters eastward of the "A"). Its complete lithological profile has been described, and different sections have been constructed to constrain the channel geometry. The channel filling appears as a succession of white sand lenses (containing variable quantities of lignite remains and pyrite) alternating with brown to black clay beds, rich in organic matter and sideritic nodules.

Different types of faulting are observed in the Danube-Bouchon's Hautrage quarry. It includes hydroplastic faults (roughly E-W oriented, as shown in fig. 1.C) with various clay injections along the fault planes, associated with complex features of plastic deformations. In addition, brittle faults organised in grabens are observed, inducing a plurimetric displacement of the channel basal bed. A preferential orientation of these faults is measured around N100°E (fig. 1.D). This tectonic event can be related with the major regional movements occurring elsewhere at this particular period, coinciding with the beginning of the tectonic subsidence of the Mons Basin (Dupuis and Vandycke, 1989). Some NE-SW strike-slip faults (fig. 1.E) and organised systems of joints (fig. 1.F) are also found, mainly related to younger dynamic widely recognized in the region (Vandycke, 2002).

The position of the graben gully (roughly E-W oriented) could be significant in the understanding of the causes that induce the deformations. Indeed, some previous cross sections realised in the quarry (Spagna, 2005) present a break in the dip of the layers, just in the area of the graben (fig. 2.). This could lead to the hypothesis of an opening hinge structure, surrounded by different subsidence rates. The formation of the graben could then be a response to this very local creation of space, itself induced by local deep dissolutions. The existence of deep dissolution phenomena of evaporites in the underlying Devono-Dinantian strata and its impact on deformation of the overlying strata is not discussed here. However, the very well oriented fault system rather suggests the existence of a regional crustal activity. The real link between these two potential factors of subsidence and deformation has not been clearly demonstrated yet.

As a conclusion, the observed deformations and their causes (the regional crustal tectonic activity and/or the local deep dissolution) are synthetized and placed on a regional time scale (fig. 3).

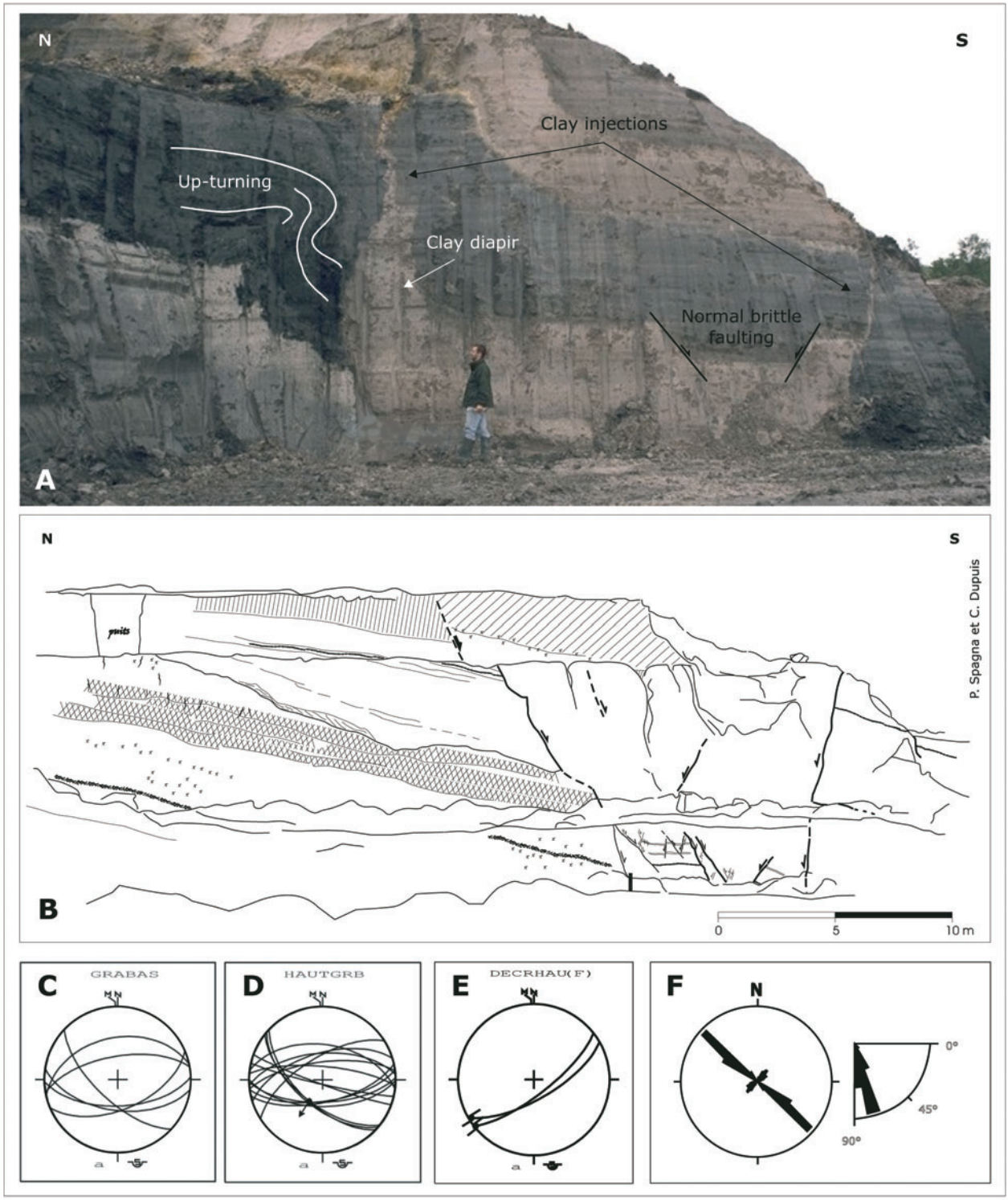

Figure 1: A. N-S profile in the wealden facies of the Danube-Bouchon quarry, with clay injections along fault plane, up-turning and normal brittle faulting in graben structure; B. N-S cross-section with detail of the faulting in the graben; C. to E. Stereographic projections of the faults and joints observed: C. hydroplastic faults with clay diapir and injections; D. normal faulting in the graben; E. Strike-slip faults; F. rosace of joints observed in the black clays (from Vandycke, 2007 and Spagna, *in progress*).

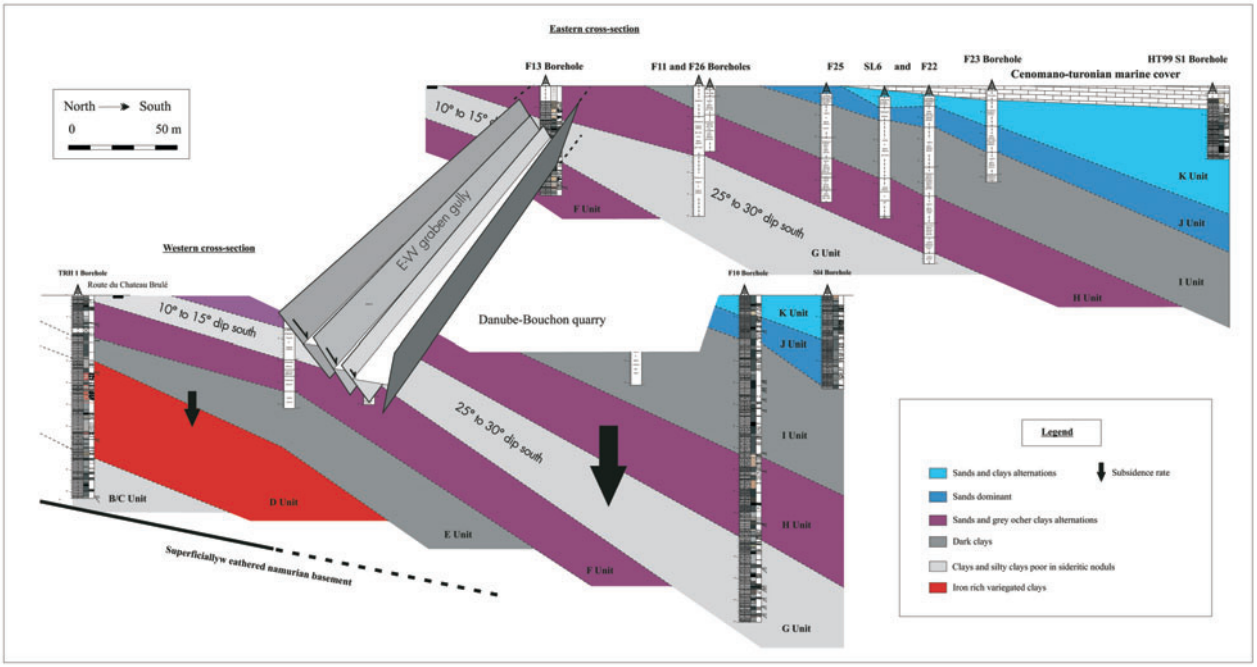

Figure 2: Position of the graben gully: the different lithological units defined present a dip increase from north to south (around 12° in the north part and more than 25° in the south). The observed graben gully is just localised in the area of the dip change. The two black arrows illustrate the potential variation of the subsidence rate on both sides of the graben gully.

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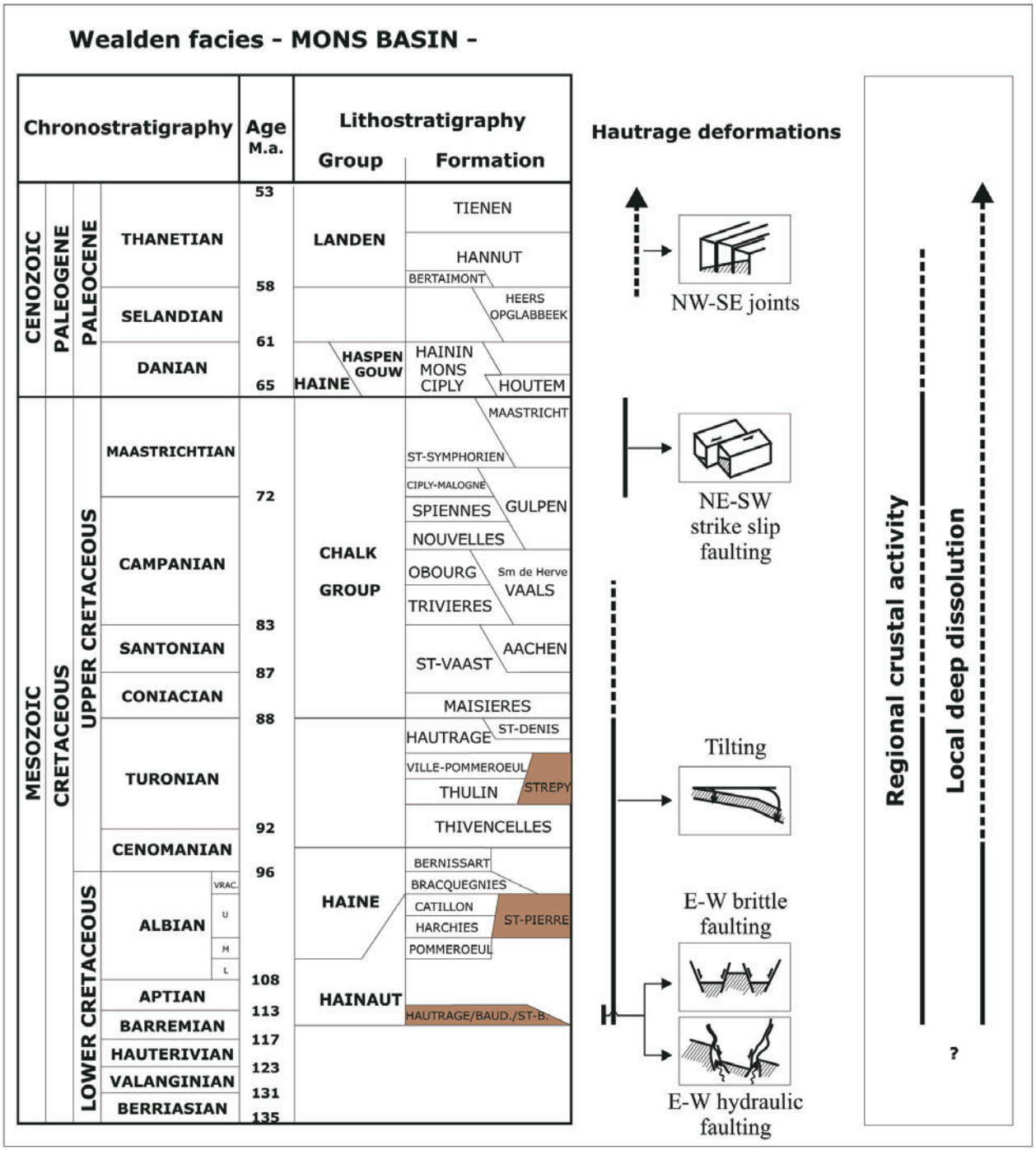

Figure 3: Synthesis of the main observed deformations and their causes in the wealden facies of the Danube-Bouchon quarry.