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THE FAULTED ZONE OF NORTH HINDER (SOUTHERN NORTH SEA)

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ABSTRACT.- High-resolution reflection seismic investigations carried out in the past decade by the Renard Centre of Marine Geology (State University of Ghent) have shed some new light on the tectonic setting of the offshore extension of the London-Brabant Massif.

A classical view is that this Palaeozoic basement high behaved throughout post-Hercynian times as a rigid unit, unaffected by the major Mesozoic and Cenozoic deformation phases which left their scars along its periphery.

Some doubts may however be cast on this model, particularly in view of the observation of a sequence of troughs and faults in the Mesozoic and early Cenozoic cover of the Brabant Massif. These deformations can be subdivided into three main groups: the North Hinder Structures, the Gravelines Structure and the Goote-Raan Structures.

The North Hinder Structures consist of a N50°E-trending alignment of synclinal troughs in the Eocene cover sediments (mainly Ypresian clays). These deformations seem to drape block-fault structures affecting the underlying Palaeocene and Cretaceous units over a total length of nearly 50 km. The amplitude of the drape deformations amounts to several tens of metres, with a local peak-to-trough maximum of about 140 m. The Gravelines Structure is a major trough with an amplitude of about 120 m, affecting Mesozoic and Cenozoic beds off Gravelines. The Goote-Raan Structures form an orthogonal set of flexures, faults and narrow, elongated synclines, of low amplitude (a few metres).

Dating the above structures is at the present time still highly speculative. However, the observation of unconformities at three different stratigraphic levels and in close association with the deformation zones suggests three deformation phases: an initial Mesozoic or early Palaeocene event, a possible tectonic pulse at the Lutetian/Bartonian boundary and a main folding phase at the Eocene-Oligocene boundary.

The multiplicity of tectonic phases in time does not imply that these structures would be structurally unrelated. In particular the North Hinder Structures and the Gravelines Structure are considered to be the surface expression of reactivated faults associated with rift-like structures in the Palaeozoic basement, possibly of similar nature and offset by a northwest trending fault.

The «en échelon» folds of the North Hinder Structures can be interpreted in terms of two different strike-slip reactivation modes: drag folds caused by a sinistral strike-slip movement along the northeast trending basement fault, of drape folds above extensional faults bounding tilted basement blocks, in which case the most probable origin would be a dextral strike-slip movement along the basement fault. The local structural context might argue for the drape folding hypothesis. However, a sinistral strike-slip movement on a northeasterly trending fault would better fit into the regional Northwest European stress field model for Eocene times.

A final reference should be made to the offshore seismicity of the Brabant Massif, which no doubt reflects the recent activity of old basement scars. Three historical earthquakes of magnitude larger than 5.0 have had their epicentre on the offshore extension of the Brabant Massif, one of which caused major flood wave damage to Calais. Old faults never die.

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