STOP **CITADELLE DE NAMUR**

by J. BOUCKAERT & N. VANDENBERGHE

1. LOCATION AND REFERENCES

Two sections will be visited, the Route Merveilleuse section at the top and the footpath below the Tour des Cointes (fig. 1).

The original descriptions of the sections exposed can be found in KAISIN, F. (1924, 1933a, b).

The stratigraphy was established by J. BOUCKAERT (1961). The nature of the deformations in the sections is discussed by N. VANDENBERGHE & J. BOUCKAERT (1984).

2. DESCRIPTION

a. General structure and stratigraphy

The northern limb of the Namur syncline shows strata all striking roughly east-west and dipping towards the syncline center.

Therefore from SW to NE on the Citadelle progressively older rocks are exposed (fig. 2). Along the Route Merveilleuse the Namurien B to A limit is exposed.

The general structure of the Citadelle's Namurian is best reflected by the mapping of the Ford d'Orange coal vein in the former underground exploitation. It shows a regular dip interrupted by several almost steplike northerly downfoldings of the strata. It is the opinion of the authors that several of the deformations observed in the two sections can not be related directly to this structural scheme.

The latter scheme is due to the prograding from the south of the Hercynian fold belt at the end of the Westphalian ; the front of which is situated 5 to 6 km south of the Namur Citadelle.

b. Deformation features

- Chaotic shale masses.
  At both ends of the Route Merveilleuse a section a chaotic shale mass can be observed over a few meters distance. The SW end mass was already discussed by KAISIN (1924). In his opinion a reversed anticlinal is involved whose top is cut off by a thrust fault bringing other horizontal sandstone beds over the structure ; the chaotic clay mass would then be a fault zone. Although his explanation was simply tectonic, he recognized that a plastic deformation of the sahle mass was required to explain the structure.
  It should be noticed that a both sides of this unstructured shale mass regularly disposed strata are both rather abruptly bent upwards.
  We note that the detailed stratigraphic field work did not allow a major thrust fault at this locality (J. BOUCKAERT, 1961

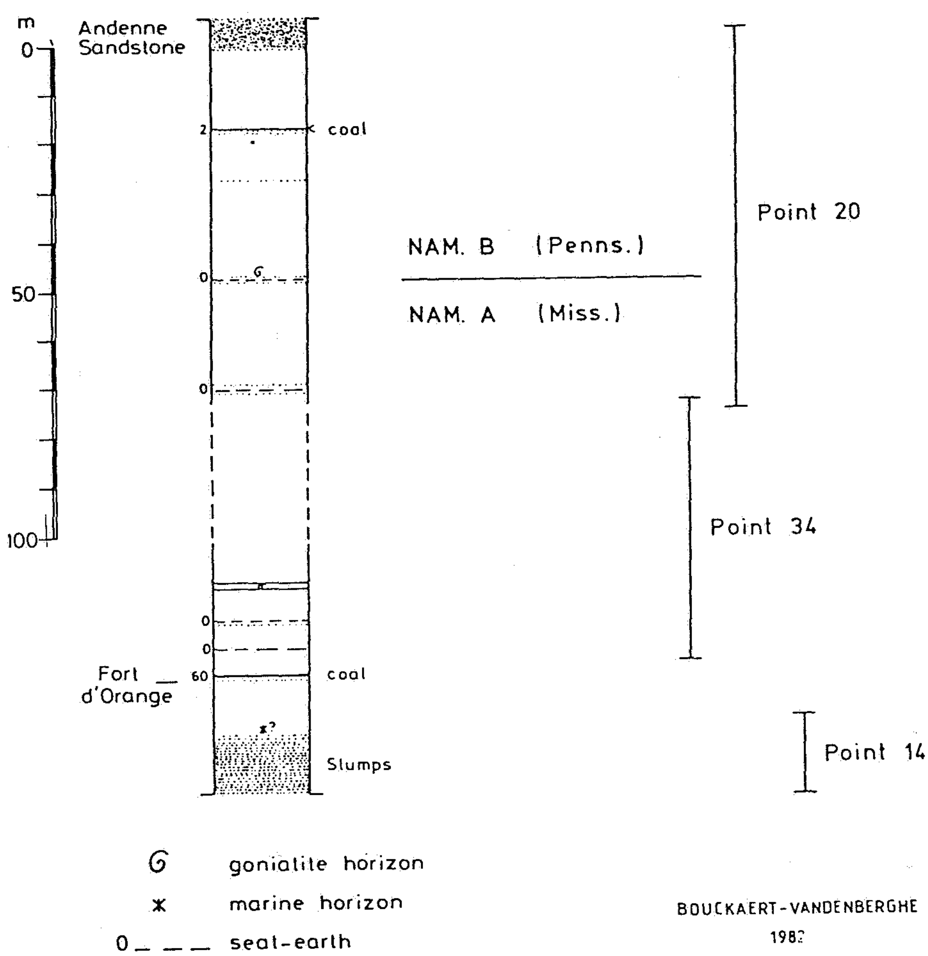

Figure 2.

CITADEL OF NAMUR

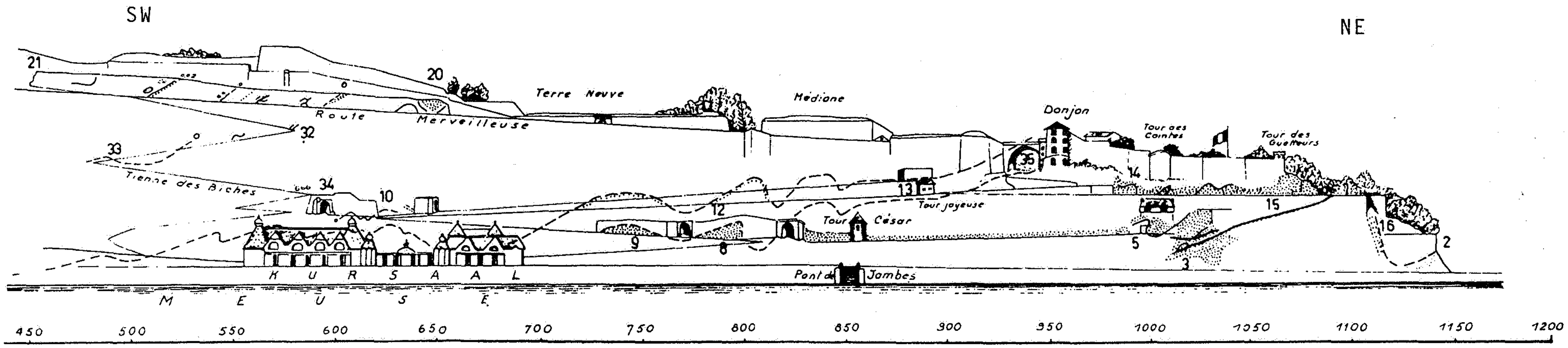

Figure 1.

p. 361) and that where a major fault was mapped, the Faille transversale du Château (near the Donjon), no broad deformed shale zone was found.

- The irregular disposition of the sandstone blocks at the side of the shale mass discussed above, just above a thin coal bed and squeezed into intensively deformed shale (plissote) also has to be taken as an indication of plastic deformation.
Such intensively deformed shale with broken up sandstone layers can also be found locally in the section.
- Flat lying fold in which the shale layer clearly has been squeezed out between thin sandstone beds.
- Intensively contorted and convoluted finely laminated rock whose deformation intensity increases towards a fault plane which is cutting off the contorted layers. The same type of convoluted bedding is also present in the lower limb of an asymmetrical anticlinal structure below a reverse fault coinciding with the fold axial plane which itself shows a rather complex structure.
The convolution deformation is thought to be indicative of high pore pressure in a sediment consisting of a finely laminated alternation of permeable and less permeable layers. Obviously this would require an origin of faultplane and fold in still wet sediment.
- The section along the foothpath below the Tour des Cointes starts in the SW with a regular, slightly dipping series of sandy shales passing almost gradually into a structurally complicated part containing at least five unconformities, reversed strata, shales dragged by overlying sandstones and continuing to the north into a section with a few thight cuspate folds. At the north end of the exposure (under the Tour des Guetteurs) the strata are again very regular with rhythmically alternating shales and sandstone containing a level with load coast features.

c. Honeycomb structures

The occurrence of spheroidally laminated structures often making up the whole mass of the silty shale is typical for the Namurian sedimentary rocks in the Namur area. Although not known from similar lithologies in Paleozoic formations in Belgium very similar honeycomb fabrics occur in the Namurian shaly rocks of County Clare, Eire.

At the Namur Citadelle the spheroidal structures are often explained as a recent weathering phenomenon. Indeed it seems logical to assume the spheroids originated after the joints developed and the stratal boundary planes opened. However the particular association of the structures with a stratigraphic level through the basin suggests an early precusor for the actual structures seen today. We suggest dewatering might have played a role.

3. DEFORMATION HISTORY

At the time of the main deformation in the nearby Hercynian folded rocks, the Asturian phase near the end of the Westphalian, the Namurian rocks now exposed at the Citadelle were buried at least about 3 000 m, based on the coal rank.

Even during the deformation the pressure never reached the stage where pressure cleavage developed, the beginning of this development requires at least 4 000 to 6 000 m burial depth.

The burial depth reached at that time was the deepest ever for these rocks and their lithification and compaction as seen today goes back to that time. Therefore the acme of the Asturic deformation could not produce the plastic deformations observed because on the one hand water content was already much too low and on the other hand deep structural levels were never reached to allow again plastic deformation styles. Therefore it is assumed that several of the deformations observed go back to Namurian time itself. When exactly is difficult to say. Clay deformation under a sand cover of some tens of meters is known from the Mississippi delta ; the clays in the Belgian Paleogene are known to produce diapiric structures and folds and breccia if unloaded by erosion.

Besides it is not excluded that some of the deformations represent slumps in the sedimentary environment itself.

The fact that all the axes of the penecontemporaneous deformation folds are parallel to the strike of the strata and hence also to the Asturian folds documented by the geometry of the Fort d'Orange bed then means that the Namurian deformation are due to the same gross stress field as active during the Asturic phase. Therefore in our opinion the soft sediment deformations observed in the Namurian rocks of the Citadelle reflect the at that time ongoing Hercynian compression, which was shortening the Variscan foredeep basin (early tectonic deformation). This compression ultimately led to the acme Asturian folding and thrusting.

The brittle deformation style and the quartz vein filling reflect this phase in the Citadelle outcrops.

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