

## DISCOVERY OF TURBIDITICAL LEVELS IN THE LATE ORDOVICIAN OF THE SENNETTE VALLEY (BRABANT MASSIF, BELGIUM)

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(3 figures)

**Abstract.** – The section of the Brussels-Charleroi canal between Asquempont and Fauquez provides good outcrops of black shales attributed to the Llandeilo by LEGRAND (1967) and dated by MARTIN and RICKARDS (1979) as lower Caradoc using graptolites, chitinozoa and acritarchs.

The detailed study of this section, including its strongly tectonized parts, proves for the first time the presence of distal turbidites built up of the divisions c, d and e from the BOUMA-sequence.

The polarity within the turbidites indicates that the general structure is an overturned anticline and is in fact a synforme with some additional folds.

### INTRODUCTION

The section of the Brussels-Charleroi canal provides the most complete profile of the Caledonian rocks, though tectonically complicated, in the southern part of the Brabant Massif. From north to south most of the Cambrian, Ordovician and Silurian formations described elsewhere in the Brabant Massif occur here.

At Asquempont an important fault ("faïlle d'Asquempont") brings into contact Cambrian (assise de Oisquercq) and lower Ordovician rocks. Between the bridges of Asquempont and Fauquez the different lithological units or formations of the Ordovician have been identified (LEGRAND, 1967 ; MARTIN & RICKARDS, 1979). One of them is a succession of black shales with some small arenaceous beds.

During the beginning of the fieldwork (1988) the section was visited by the International Workshop on the Caledonides of Eastern England and the Brabant Massif. This visit was the base for the following results.

### PREVIOUS STUDIES

In 1921, FOURMARIER (p.23) studied outcrops along an older section of the canal (see fig. 1). He recognized black shales with some small layers of greenish sandstone in between the "quartzophyllades"

of the Ordovician and the often mentioned (COUNTRY, 1930 ; MAILLEUX, 1938 ; ...) late Ordovician fossiliferous layer visible south of Fauquez. These outcrops were situated at the eastern side of the older section of the canal, about 600 m south of the abandoned station of Virginal.

In 1967, LEGRAND (p. 39) described a new section after the construction of the new canal (1962-1967). He found graptolites of the zones of *D. 'bifidus'*, *N. gracilis*, *P. linearis*. He supposed that all Ordovician stages, except the Tremadocian, were present and he put the black phyllites alternating with thin layers of sandstone into the Llandeilo (SI1b).

He also noted that these beds form an "anticlinal retourné" ("overturned anticline") with "intense local complications". At the southern extremity he found specimens of *Nemagraptus gracilis* indicating the zone with the same name.

In his general geological section along the canal Bruxelles-Charleroi (plate I) he draws folds on the place where the Llandeilo (SI 1b) crops out, which are

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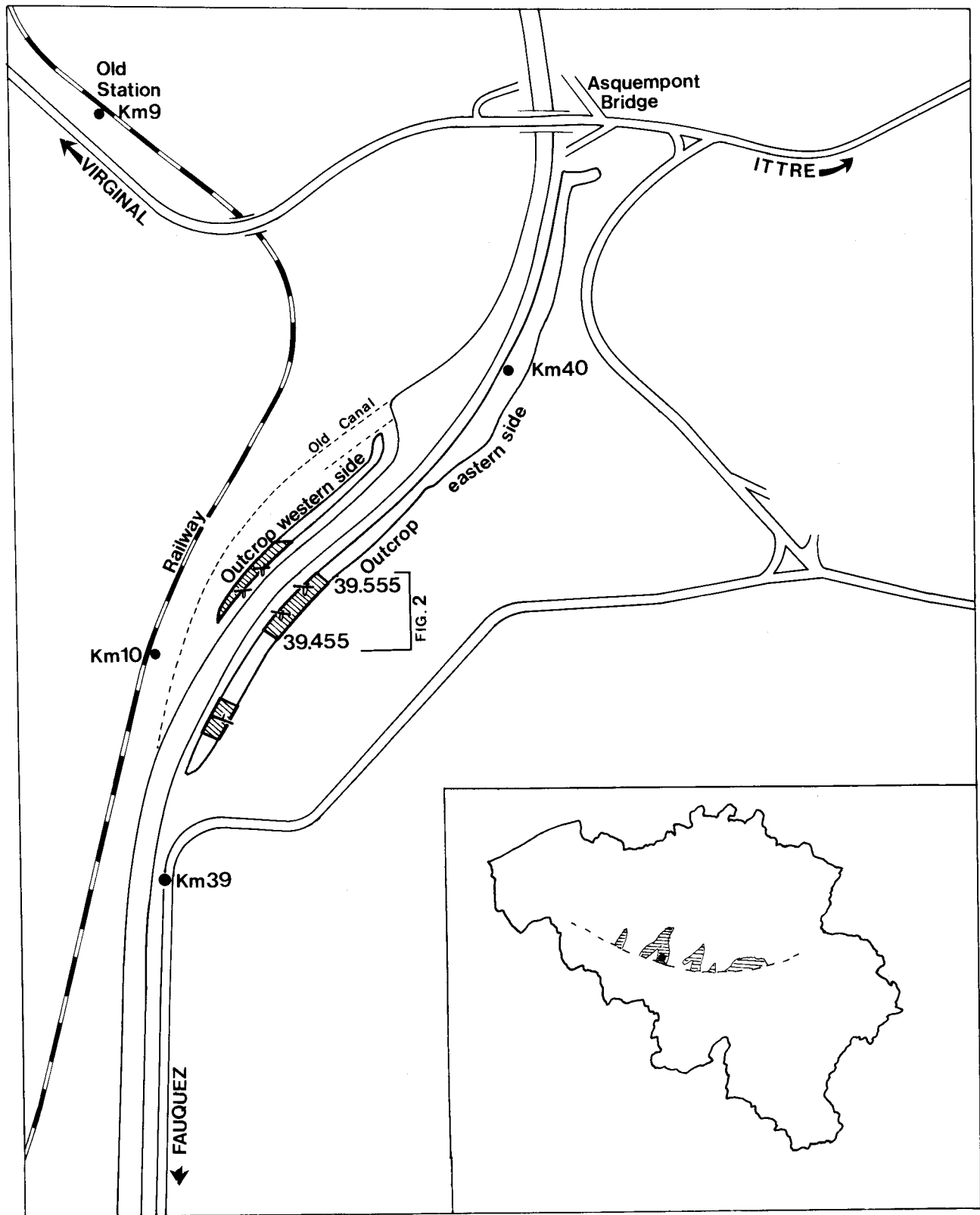


Fig. 1. : Localisation of the studied parts of the outcrops of the Brussels-Charleroi canal at the South of the Asquempont bridge.

however in contradiction with his general structural model of the Brabant Massif presented in the text of the same publication (p. 45-48).

In 1979, MARTIN & RICKARDS reinvestigated geologically and paleontologically (graptolites, acritarchs and chitinozoa) the Sennette Valley, axing mostly on the canal section south of Asquempont. MARTIN distinguished in this section six different lithological units (units A to F). Unit F, the highest, is composed of blue to black shales, with intercalations of psammitic layers (thinner than 5 cm). She didn't recognize LEGRANDS "overturned anticline" but noted that field observations and paleontological arguments indicated the presence of a syncline with the core near Km 39.500.

RICKARDS studied the specimens of graptolites collected by MARTIN from the strata mentioned for the first time by LEGRAND (1967). In the lithological unit F (in the core of the synforme) two graptolite levels belonged to the *Nemagraptus gracilis* zone or to the *Diplograptus multidens* zone indicating a Llandeillian or early Caradocian age.

The acritarch and chitinozoa assemblages pointed to an early Caradocian age for this part of the lithological unit F.

The previous studies present a view where the units are becoming younger from north to south. The last study indicates a syncline in the unit F. In these studies not all levels are dated neither is known if the sequences are complete nor if lacunas occur.

### FIELD OBSERVATIONS

Since the construction of the new canal the vegetation has recovered many of the talus and now it is more difficult to point out all the different lithological units. The unit F of MARTIN & RICKARDS is still outcropping on both sides of the canal.

The localisation of the outcrops of the Unit F of the eastern and western side of the canal is indicated on fig. 1. The section of the eastern side between Km 39455 and Km 39555 is illustrated in fig. 2.

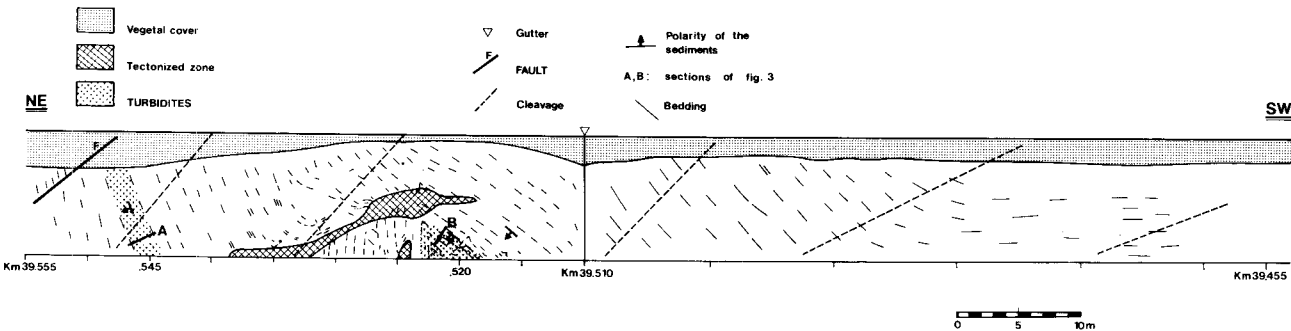


Fig. 2 : The turbidites indicating the overturned beds at the western side of the canal between Km 39.455 and Km 39.555.

### Outcrop eastern side

The outcrop of the eastern side (the same side studied by MARTIN & RICKARDS, 1979) is mainly made up by dark pelites (between Km 39455 and Km 39555).

These rocks are strongly affected by the slaty cleavage which dips to the North, weakly at the southern part of the outcrop (15-20°) and at the northern part with an angle up to 60°.

The bedding is difficult to trace (it is impossible to follow one layer throughout the whole outcrop) except at the southern part (between Km 39510 and in the antiform at Km 39455) where thin beds containing pyrite point out the bedding and at the northern part where the dark shales alternate with lighter coloured arenaceous layers (at Km 39545 and in the antiform at Km 39520). These levels already mentioned by LEGRAND (1967) and by MARTIN & RICKARDS (1979) are in fact turbidites.

Only the upper parts of the BOUMA-sequence are present : base cut-out sequences (BOUMA 1962) containing the divisions c, d and e (division c : with current ripple lamination ; division d : upper parallel lamination ; division e : compact layer).

The absence of the divisions a and b is characteristic for distal turbidites (BOUMA 1962).

It is impossible to show if both turbidite levels observed in the two places can be correlated.

The cleavage remains parallel with a dip (40-60°) to the North, throughout the antiform proving that the folds are unrelated to the slaty cleavage. Hence the antiform is probably of a syndimentary deformation and not of a tectonic origin.

In the fig. 3. are illustrated the sections of parts of the turbidite-sequences occurring at Km 39545 (A) and Km 39520 (B). The localisation of these section is indicated in fig. 2.

Three arguments for the identification of the polarity of the bedding prove the overturning of all the beds of this outcrop

- (1) : the succession of the divisions of the BOUMA-sequence
- (2) : the base of each sequence (with possible flute and load casts)
- (3) : the current ripple lamination (division c).

Consequently, what we observe is a large synforme with its core at about Km 39500 (LEGRANDS "overturned anticline"). A small anti-forme of probable syndimentary origin (at Km 39520) and an overturned block (Km 39545) are formed in the turbidite levels and cut by the cleavage.

Outcrop western side

The western side of the canal (fig. 1.) also provides a good outcrop (more than 130 m long) of the lithological unit F.

The lithology is exactly the same as on the eastern side : black pelites with some turbidites.

The rocks dip weakly to the South-South-East (strike between N 40° E and N 70° E, dip between 25°

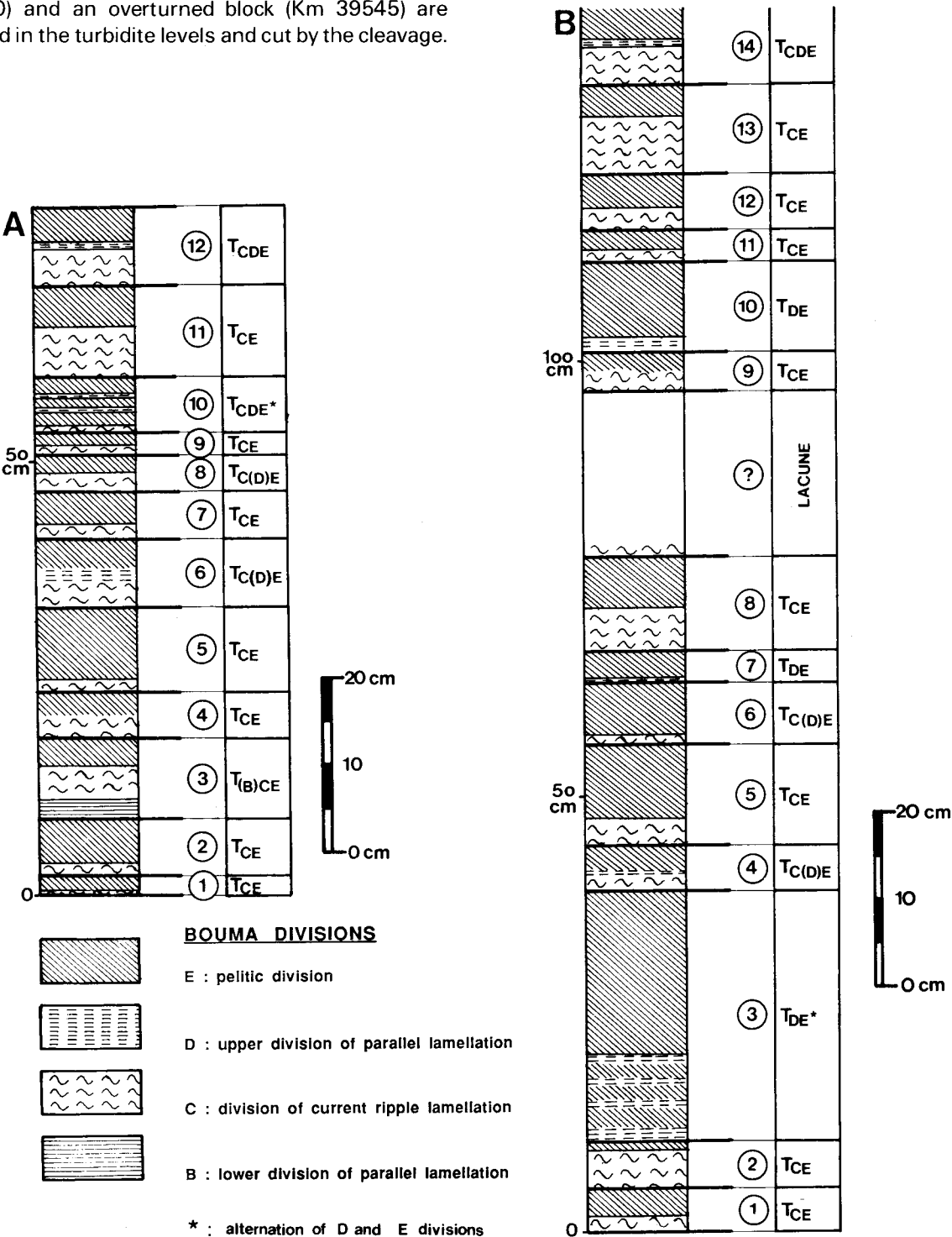


Fig. 3. : Parts of the turbidite-sequences occurring at Km 39.545 (A) and Km 39.525 (B).

and 30°SSE). Some folds of minor importance and small faults are present.

The turbidites provide the arguments to prove that all the beds are also overturned on this side of the canal.

## DISCUSSION

This is the first account of the presence of turbidites in the Ordovician of the Brabant Massif. Turbidites are known in the Brabant Massif in the Cambrian (VAN DER AUWERA & ANDRE, 1985) and in the Silurian (VERNIERS & RICKARDS, 1979 ; VERNIERS, 1982, 1983). Turbidites of Ordovician age have been described from other caledonian areas of Belgium : in the Ardennes (LAMENS, 1985) and in the Condroz-ridge at Ombret (MARTIN et al. , 1970).

In 1983, the lithological unit F with the turbidites in the Sennette valley was called "formation d'Iltre" by BEUGNIES in ROBASYNSKI & DUPUIS (fig. 9), but unaccompanied by a formal description. This unit has, until now, not been observed in the other valleys of the southern part of the Brabant Massif. A formal description and decision about the lithostratigraphical rank is still needed.

## CONCLUSIONS

The geological structure in the Brussels-Charleroi canal section is indeed very complicated as shown by the previous authors. Over more than 100 metres all the beds are overturned.

The lack of any structural and tectonic studies does not permit to place these structures in a larger context of the Caledonian of the Brabant Massif.

The hypothetical interpretation by LEGRAND (1967: p. 45-48) is in contradiction with his own (page 39 and plate I) and our observations and therefore cannot be valid.

Taken into account the complexity of the terrain, as shown in this study, only detailed lithostratigraphical and structural tectonic studies on the whole Lower Palaeozoic in one or several valleys in the Brabant Massif will possibly lead to substantial improvements in the geotectonic history of this terrain.

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