TRANSCAR QUARRY -

STOP : VALLEE DU SAMSON

by M. SCHILTZ

1. LOCATION AND GENERAL GEOLOGICAL SITUATION

The quarry is situated on the west flank of the Samson valley, just south of Namêche. Structurally, it is part of the northern limb of the Namur syncline (fig. 1, 2). Stratigraphically about 100 m of Upper Visean limestones overlain by Namurian siliciclastics are exposed. The general strike and dip are N80°E 8°S.
Documents of the Geological Survey of Belgium : 156 W 78.

2. STRATIGRAPHY

a. *The stratigraphy of the limestonesteps E1, E2, E3 (fig. 2 and profile I)*

The lowermost 25 m of exposed limestone consists of the Grande Brèche. The base of this breccia unit (V3a) is not exposed. Breccia fragments are angular and well individualised ; some of the limestone layers gradually pass into breccia or show internally initial brecciation. We interprete these observations as indicative of collapse breccia (DELMER & BOUCKAERT, 1977 ; ROUCHY *et al.*, 1984 ; MAMET *et al.*, 1986). The breccia would then result from the solution of interstratified evaporites.

The base of the overlying ± 35 m of limestone is slightly unconformable. Seven rhythmic sequences could be identified, based on the description of the Visean limestone rhythms by PIRLET (1963, 1968). Each sequence starts with a transgressive phase (in sequences 1 and 4 ravinating at the base) during which organoclastic limestones were formed and a regressive phase during which algal limestone were formed. The rhythmic sequences together with a few characteristic beds such as thin shale layers (bed 25 is a K-bentonite) coaly seams and karstic surfaces allow a precise correlation (fig. 3) with the detailed description of the nearby Thays quarry (fig. 2) by PIRLET (1963, 1968). His stratigraphical analysis could distinguish between V3B α and β (based on foraminifera).

The deposition of the limestone in a rhythmic alternation of transgressive and regressive periods occurred at the southern margin of the Brabant shelf. According to PIRLET (1968) the thickness distribution in the area, shows that an important part of the V3bβ is lacking in the quarry. The top of the limestone in the quarry is a paleokarstic surface above which the siliciclastic Namurian starts.

The different karstic phenomena that can be observed in the quarry are schematically represented on fig. 4. The Visean karsts are of the mammillated type (WALKDEN, 1974 ; WRIGHT, 1982). Thin sections show at the very top of the limestone algal mats with a pelletoid structure and fenestrae indicating an intertidal sedimentary regime. Rootfoots and dripstones with brown laminated crusts indicate a later supratidal influence, with the development of a paleosol and karst. The large vertical karstic cavities in the limestone are of quaternary age (EK & POTY, 1982). It is possible that the partly decalcifing and weathering of the overlying Namurian has to be associated with this phase, together with the additional interstratal karst activity at the base of the Namurian. Afterwards the Namurian rocks were sinking into the karst filling the pipes and the Namurian beds became bended over the karstpipes.

b. *The stratigraphy of the Namurian (Découverte, fig. 2 and profile II)*

The Namurian is about 30 m thick and the stratigraphic determination, based on conodonts and foraminifera, in the calcareous base of the Namurian shows an E2a (LALOUX, 1983) (*). This reflects the general occurrence of a hiatus between the Visean and Namurian, spanning at least the E1, as observed in the Namur and Dinant synclines, as observed by BOUCKAERT (1963), VAN LECKWIJCK (1964), PAPROTH *et al.* (1983).

A lithological column is given in fig. 5. For the basal meters, two columns are given ; a carbonate containing one exposed at the south end of the quarry and a decalcified column as it can be observed in the north part of the quarry. The correlation is based on the top white clay bed (a K-bentonite), a thin doublet of shale seams and a nodule horizon. The calcareous ampelitic shales (definition by DELMER & ANCION, 1954 ; VAN LECKWIJCK, 1964) are black and rich in finely dispersed organic remains and pyrite. These rocks together with the marlstone layers become light weighing, pale porous silty rocks when decalcified.

The evolution of the carbonate, free quartz, organic matter and the Th and U content for the top Visean and the Namurian section are represented on fig. 6. As observed at several localities in Belgium (o.a. LEGRAND, 1956 ; JEDWAB, 1958, 1959 ; NDZIBA, 1982 ; QUINIF *et al.*, 1985) also in this section the Visean-Namurian transition is characterized by a radioactive anomaly due to high U values (*see* also Charlet *et al.*, 1985). From literature data and from autoradiographic analyses it can be stated that the U is probably finely dispersed.

The sedimentation conditions are marine (VAN LECKWIJCK, 1964). The quartz content and the numerous plant remains indicate a detrital sedimentation with continental influence. The pyrite (in the calcareous ampelites) is probably very early diagenetic.

Phtanites and phtanitic siltstones are identified. As true phtanitic beds (defined by DELMER & ANCION, 1954), these layers break into regular blocks. However true phtanites always contain cryptocrystalline quartz which is lacking in the

(*) GROESSENS, E. & LALOUX, M. (unpublished) have found in this quarry the diagnostic conodonts : *Gnathodus bilineatus bollandensis* and *Paragnathodus binodosus* and foraminifera : *Brenckleina* sp., *Turbispirodiscus leckwijcki*, *Turrispiroides* sp. and *Loeblichia minima*.

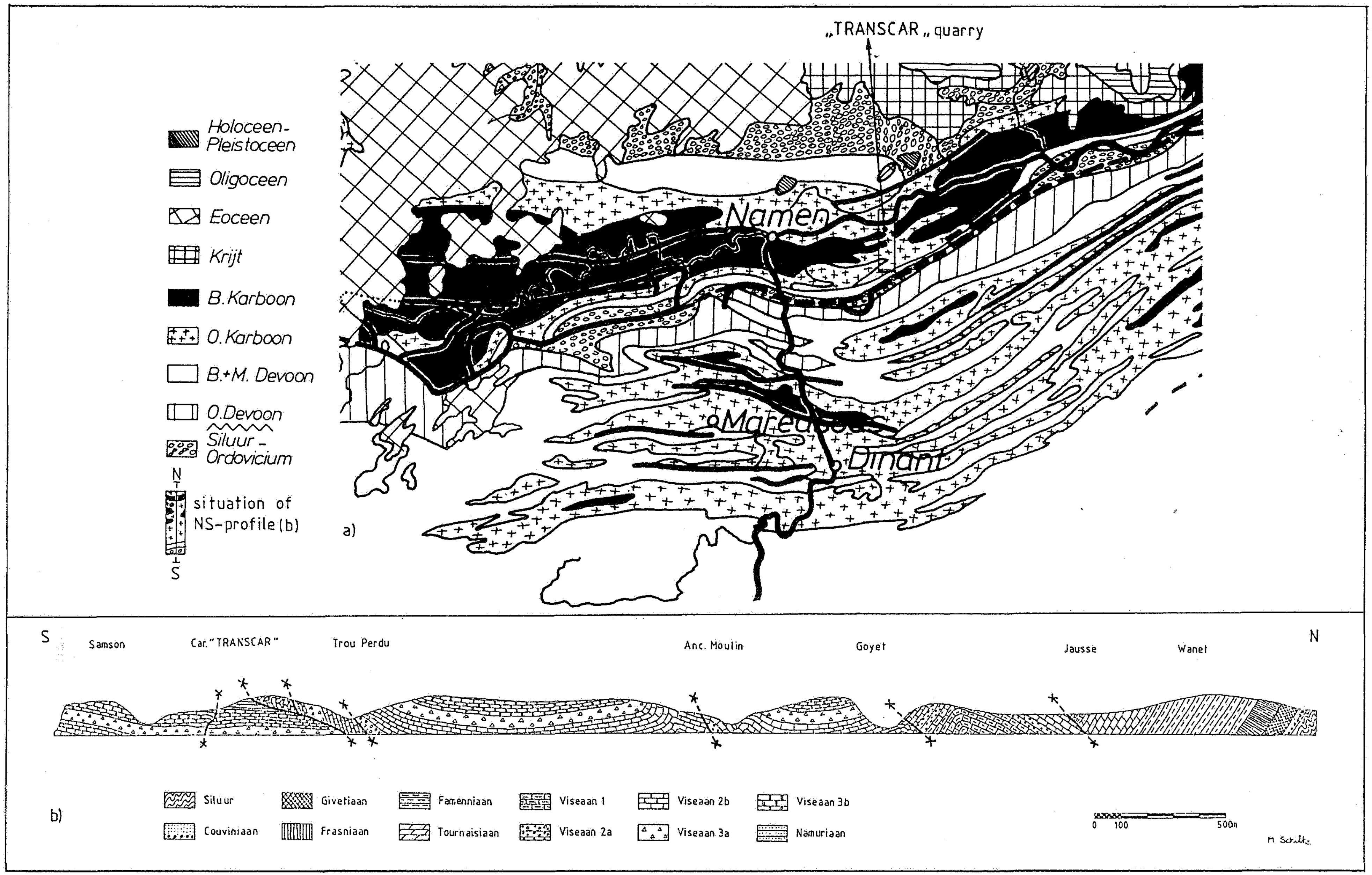

Figure 1. a) General geological situation of the "Transcar" quarry.
b) NS-profile along the Samsonvalley, based on fieldwork (1986, 1987) and Pirlet (1960, 1963).

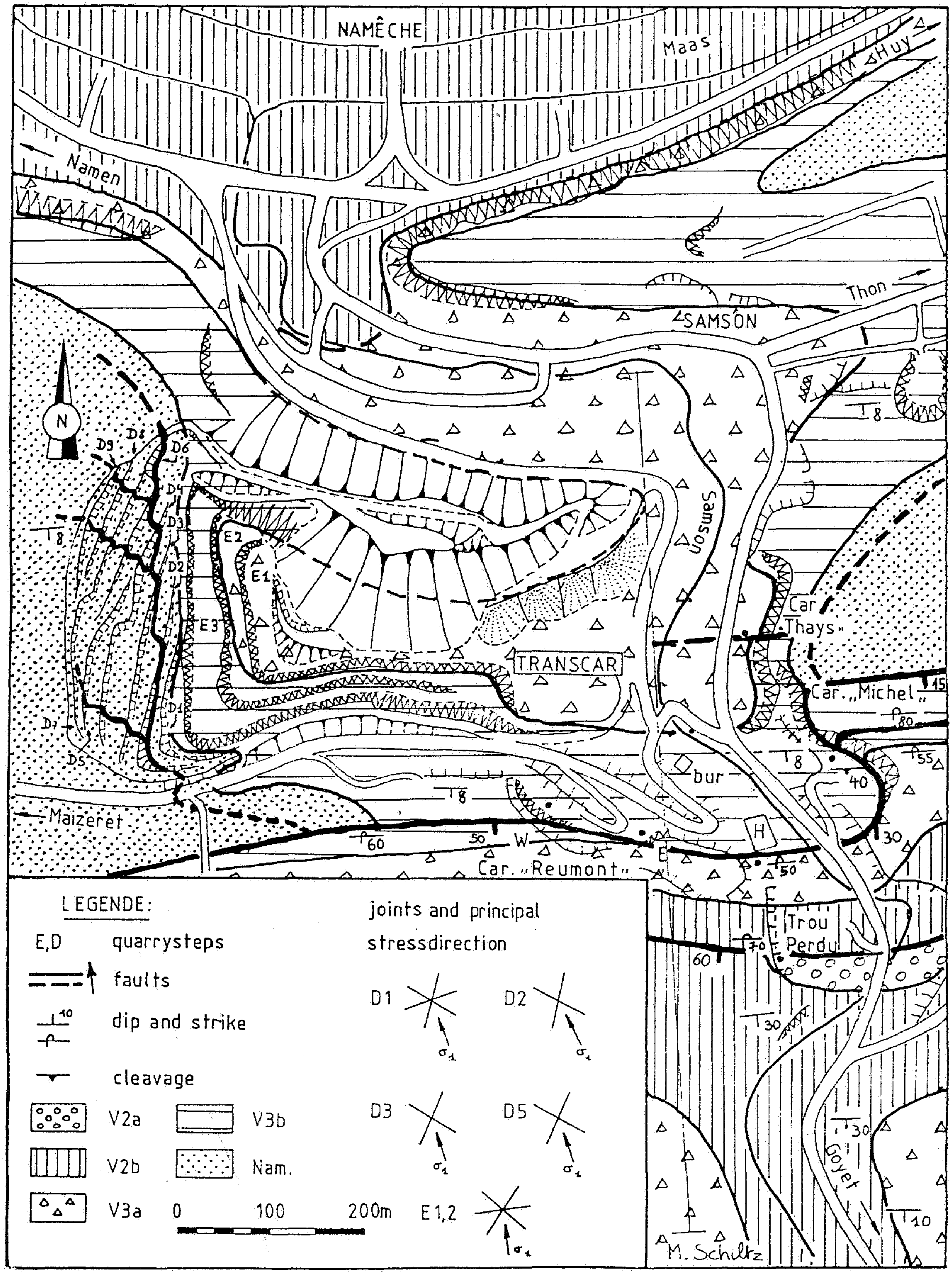

Figure 2. Structural and stratigraphic situation of the "Transcar" quarry and his environment, based on fieldwork (1986, 1987) and Pirlet (1960, 1963).

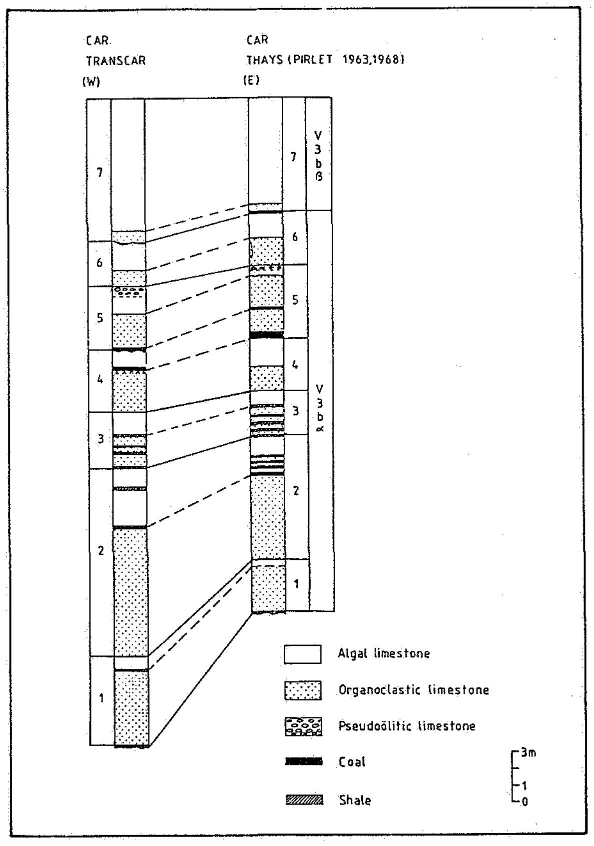

Figure 3. Correlation of the V3b from the "Transcar" quarry and the "Thays" quarry (situation *see* fig. 2).

section exposed here (except in bed 23). Maybe this is due to the decalcification and limonite impregnation.

3. STRUCTURAL GEOLOGY

a. The "Transcar" and "Thays" quarries

Tectonic deformation with a noticeable throw along fault planes occurs in the Namurian strata. Three 30S dipping faults can be followed across the Namurian section (at the A, B, C arrows on profile II) with a vertical throw of 0,1 to 4 m ; however these faults do not continue below the white clay bed (nr. 12) and seem to start from that bed. The white clay bed together with the underlaying phtanitic siltbed are themselves gliding planes along which an about 30 m long zone with small scale duplex structures can be observed (analogus to larger scale structures described by BOYER & ELLIOT, 1982 ; MITRA & BOYER, 1986). The imbrications that can be observed are formed in such a way that it is possible to calculate the horizontal displacement (fig. 7). A minimal horizontal displacement of 40 m northwards is the result. The bending of the layers and the incompletement of the sequence, which is also cutting off part of the sequence (between arrows B and C profile II) is related to the thrust fault, nearby the south. The gross tectonic picture is a "layered parallel" thrusting (RUTTEN, 1969), with imbrication faults starting asymptoticaly at the thrust planes. The orientation and relative displacement shows a stress field acting from the south. It should be noticed that the white clay at the time of thrusting might have been a more compact bentonic bed but nevertheless remained weak enough to allow gliding of strata along it.

Within the Visean limestone the effects of the deformation witnessed by the Namurian, are less conspicuous. The competent limestones do not show folding or faulting. Except for back folding (with back fault) in the former "Thays" quarry, now well exposed along the road. Such back folding is common in overthrust systems.

In the "Transcar" quarry some rare vertical stylolithes are observed, but NS oriented slickensides in the thin bituminous shale beds (non saturated layered stylolithes, WANLESS, 1979), or coaly shale beds show a relative SN movement of the limestone layers.

The joint system in the limestone has a similar orientation as in the Namurian siliciclastics and can also be interpreted in terms of a major stress component directed from the south (fig. 2).

It can be mentioned here that the amount of limestone dissolution through horizontal (sutured) stylolithes was calculated to be at least 7 to 8 %.

b. The local tectonics

The structural features observed at the "Transcar" and "Thays" quarries can be related to structural observations in neighbourring exposures (fig. 2).

In the "Michel" quarry (fig. 8a) the Visean is thrusted over the Namurian. The Visean above the thrust plane is in reversed position and folded against the thrust plane. Locally underneath the thrust plane, as seen in the quarry, the compression was sufficient large to produce a cleavage (N70°E40°S) in the calcareous ampelites of the Namurian. The thrust fault has a steeper north and south end ; the latter dips into the limestones. In exposure "H" to the west the steeper fault can also be observed. An associated secondary fault can be observed in the quarry and another fault observed in the "Trou Perdu" is interpreted in the same sense.

The backfold in the "Thays" quarry suggest that another thrustfold occurs below the now exposed rocks. In the "Reumont" quarries (fig. 2) steep faults can be observed in limestones which lie in the strike of the faults of "Michel" quarry. The southern part of the limestones in these quarries is also overturned (fig. 8b, c). The different structural observations are broadly in line with the observations made by PIRLET (1960) and are integrated in the map on fig. 2 and in the NS-profile on fig. 9. The northward displacement along the major exposed thrustfault is estimated from our profiles to have a minimal value about 100 m. A major fault has been recognised here as early as 1883 by STAINIER.

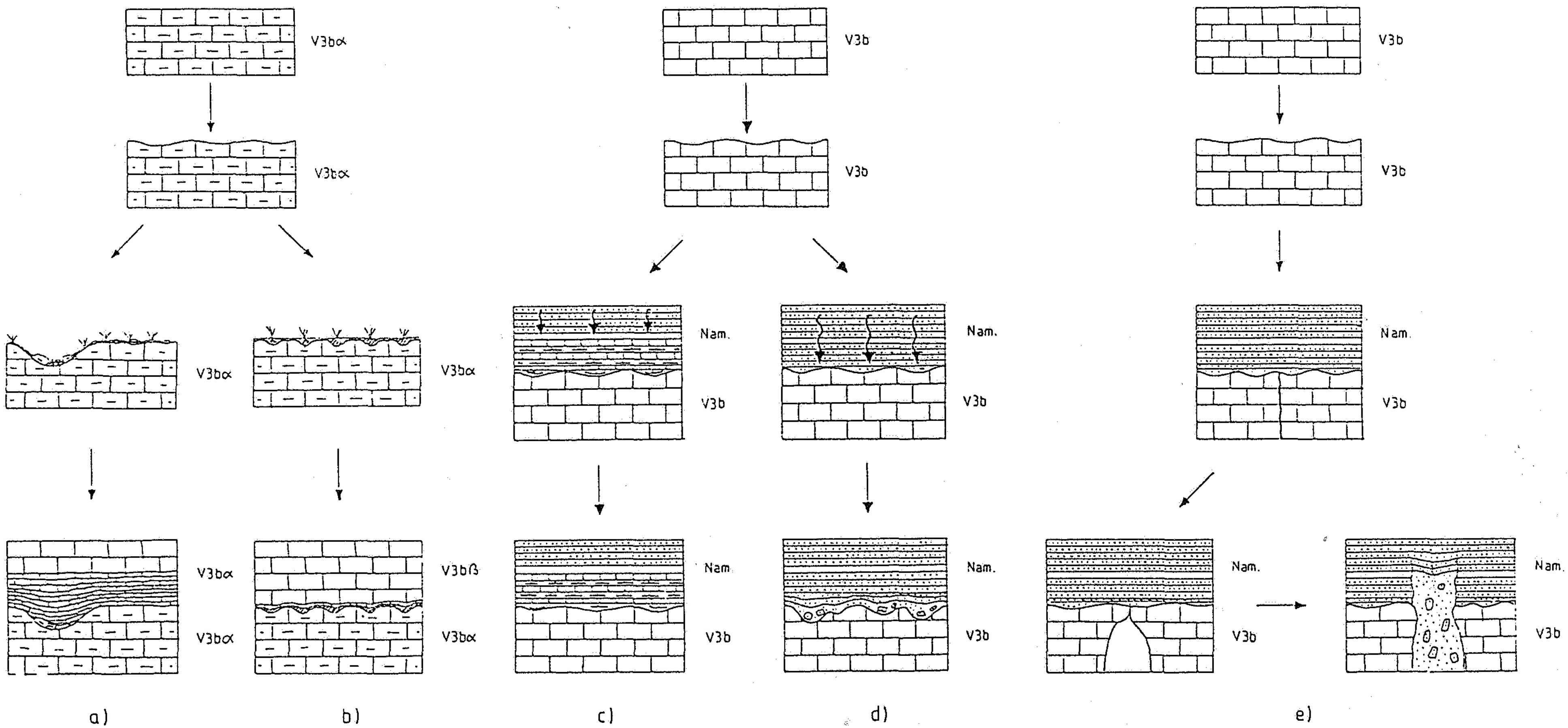

Figure 4. Karst fenomena in the "Transcar" quarry.
a) Mammilated paleokarstsurface in sequence 2 from the V3b.
b) Mammilated paleokarstsurface on V3bα - β boundary.
c) Mammilated paleokarstsurface on the Visean-Namurian boundary (South part of the quarry).
d) Interstrata karst on the Visean-Namurian boundary (North port of the quarry).
e) Forming of a karstpipe in the Visean limestone and subsequent filling with overlying Namurian.

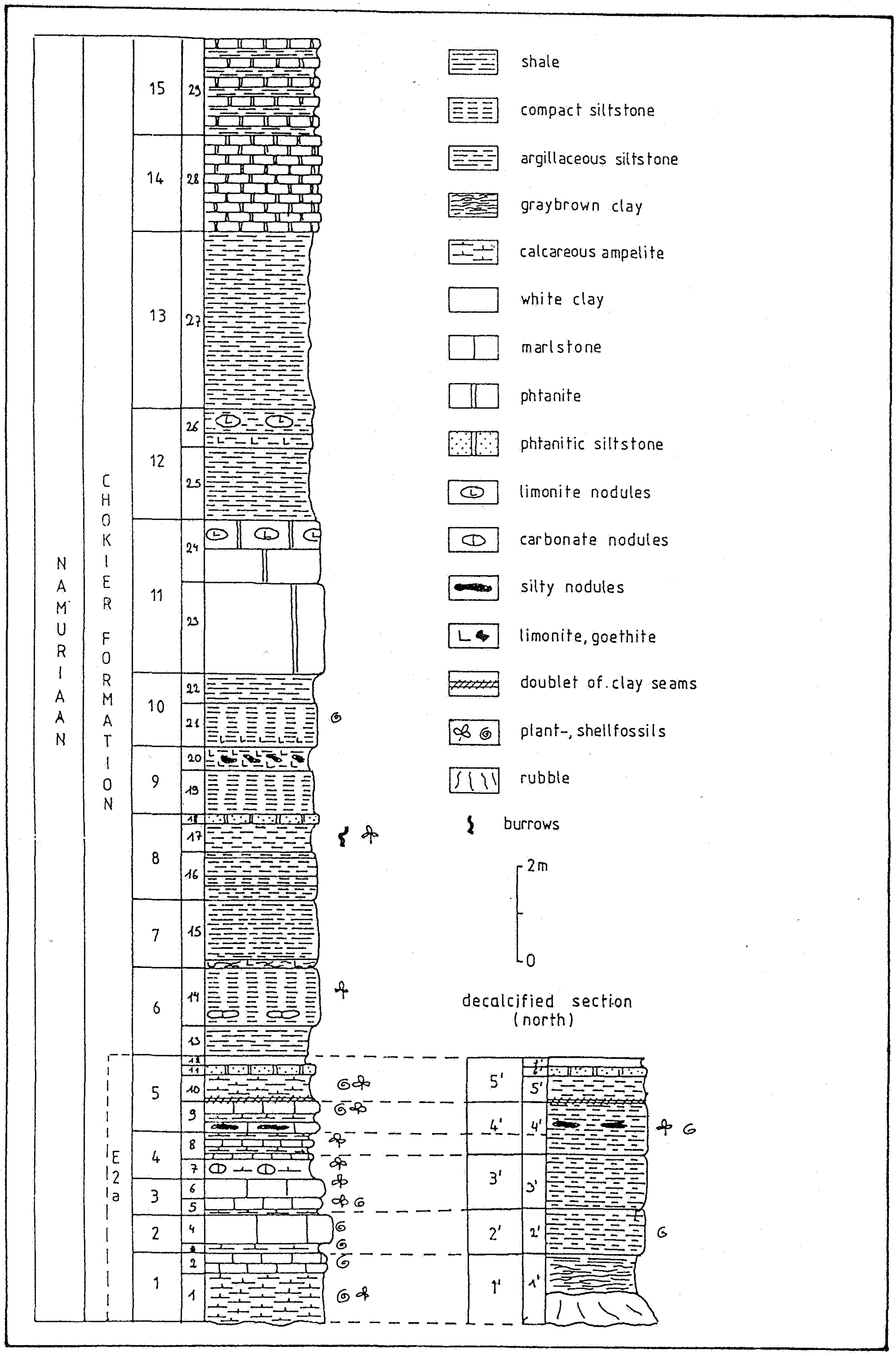

Figure 5. Lithostratigraphy of the Namurian in the "Transcar" quarry.

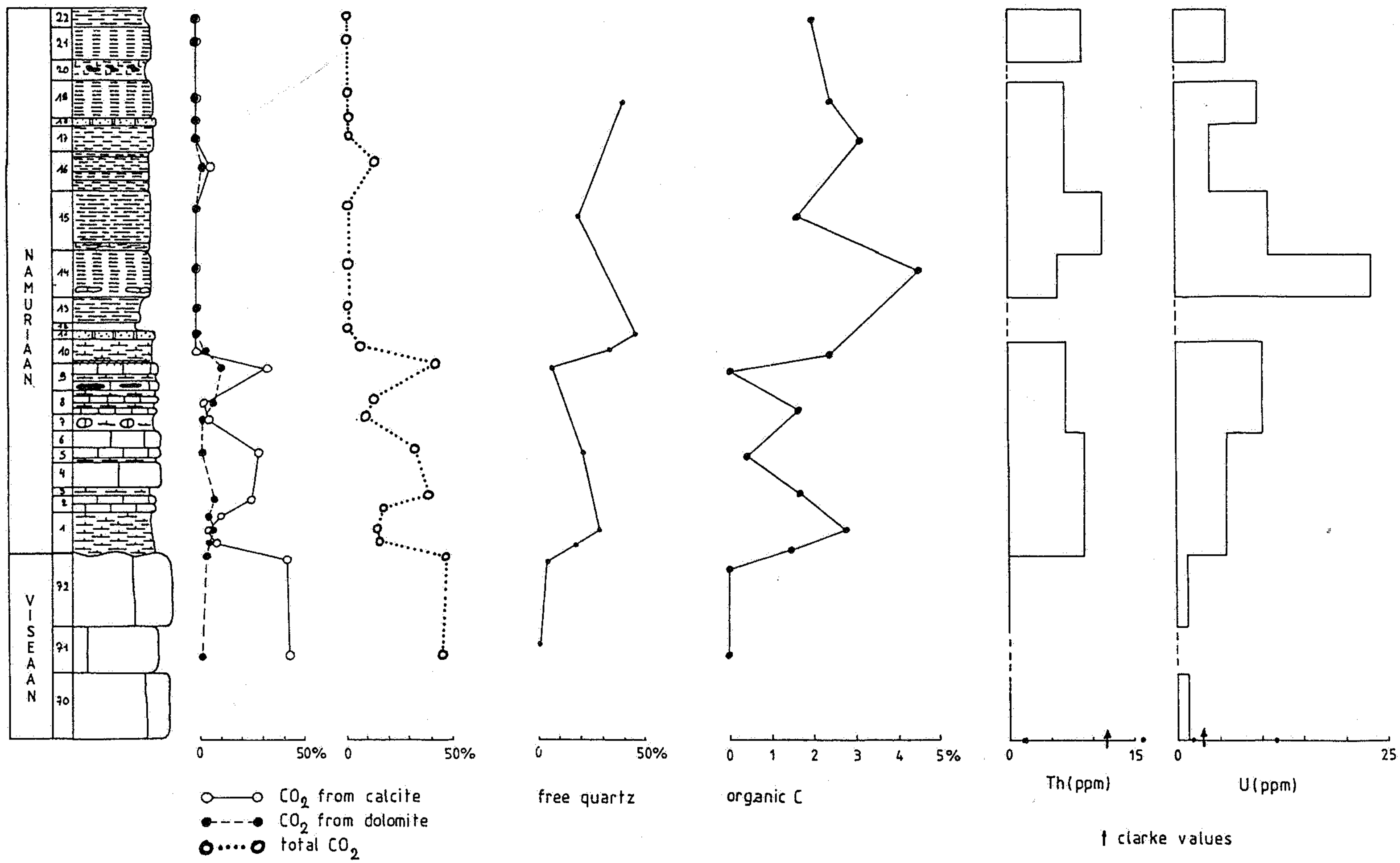

Figure 6. Evolution of the carbonate (a)-, free quartz (b)- organic carbon (c) and U, Th- content (d) at the transition from Visean to Namurian.

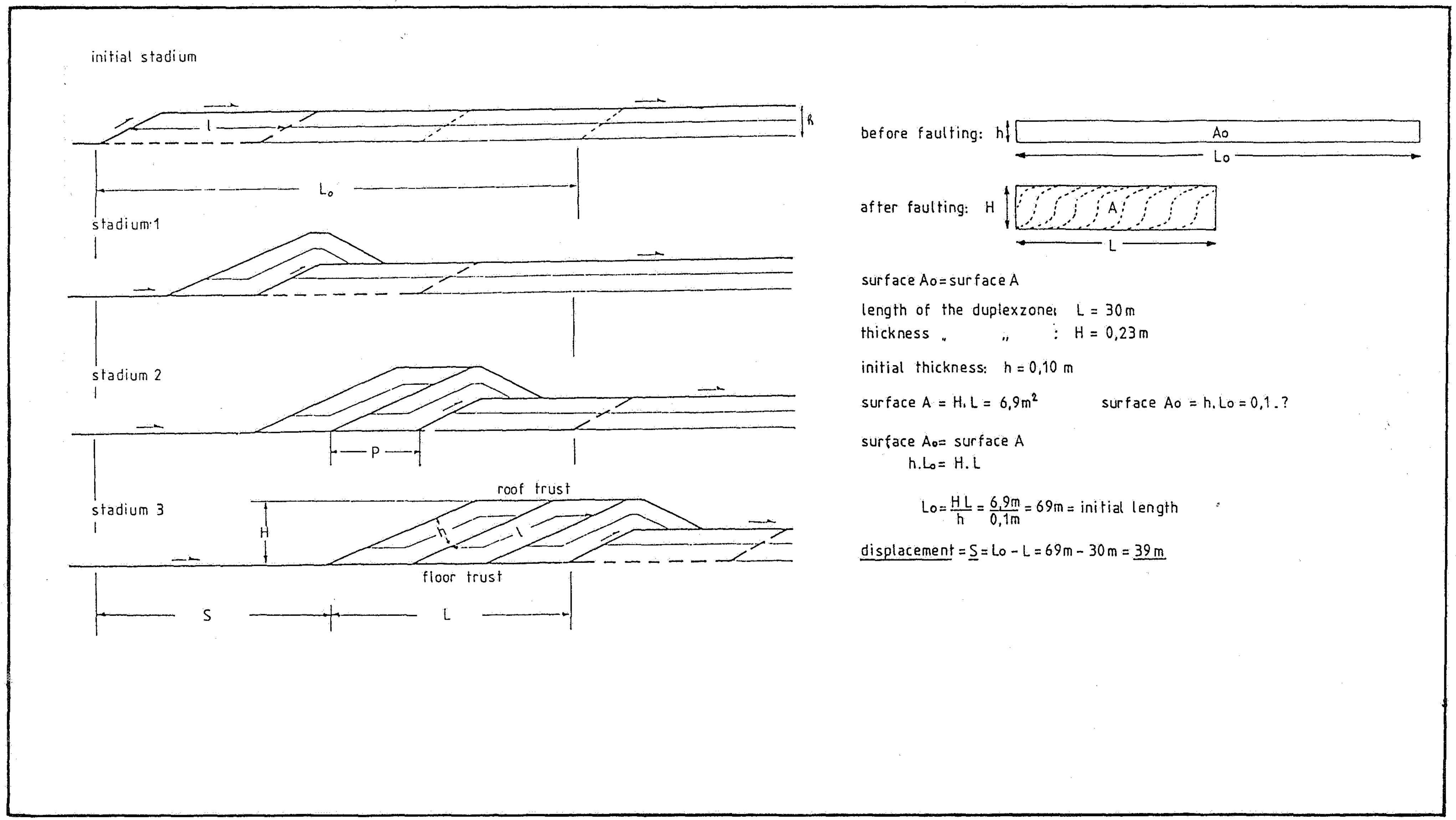

Figure 7. Mechanism of a duplex-thrust-zone and calculation of minimal horizontal displacement (BOYER & ELLIOT, 1982).

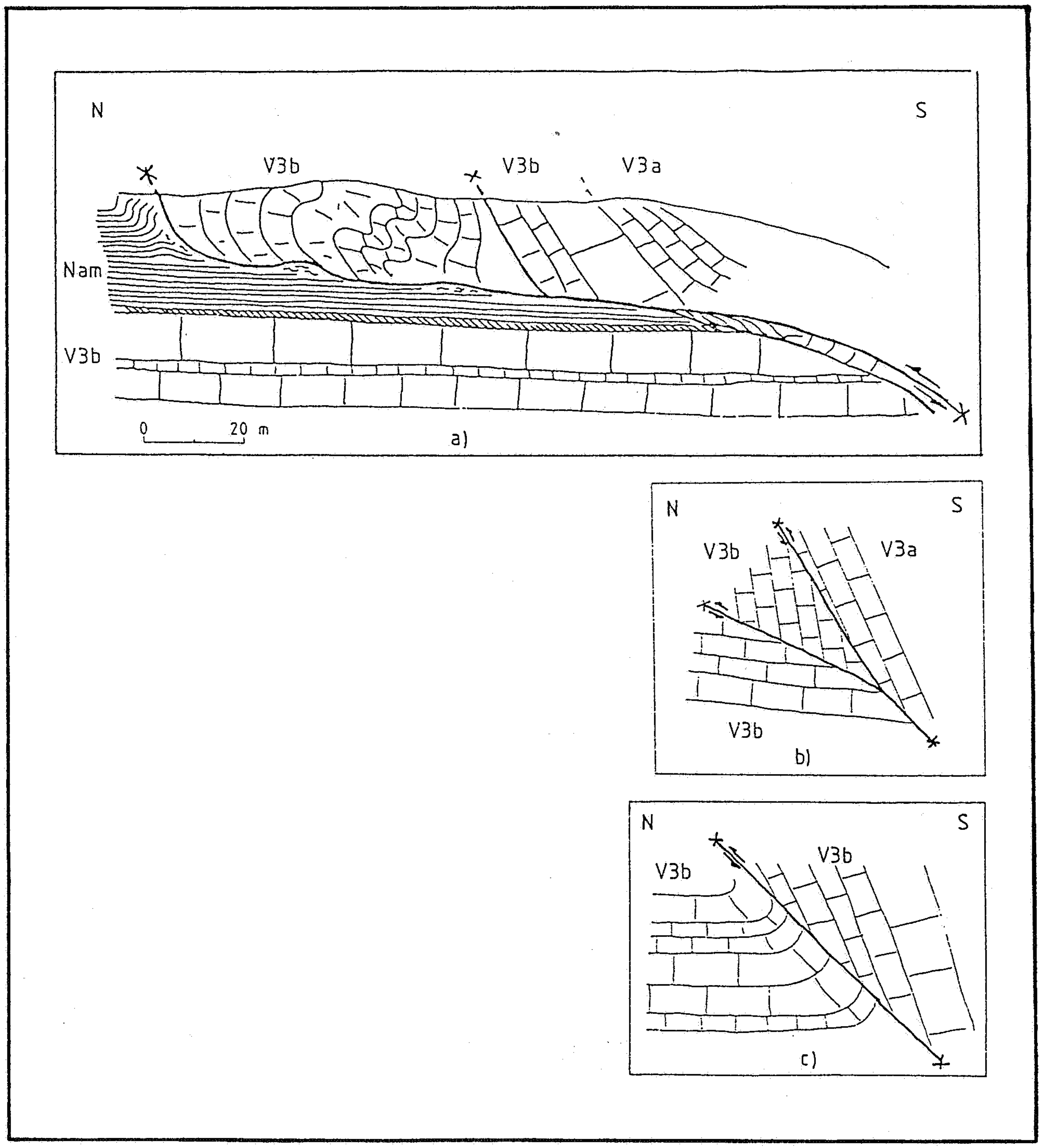

Figure 8. Progress of the thrust-fault in the Samsonvalley from east to West : a) "Michel" quarry
b) "Reumont-E" quarry
c) "Reumont-W" quarry
(situation *see* fig. 2).

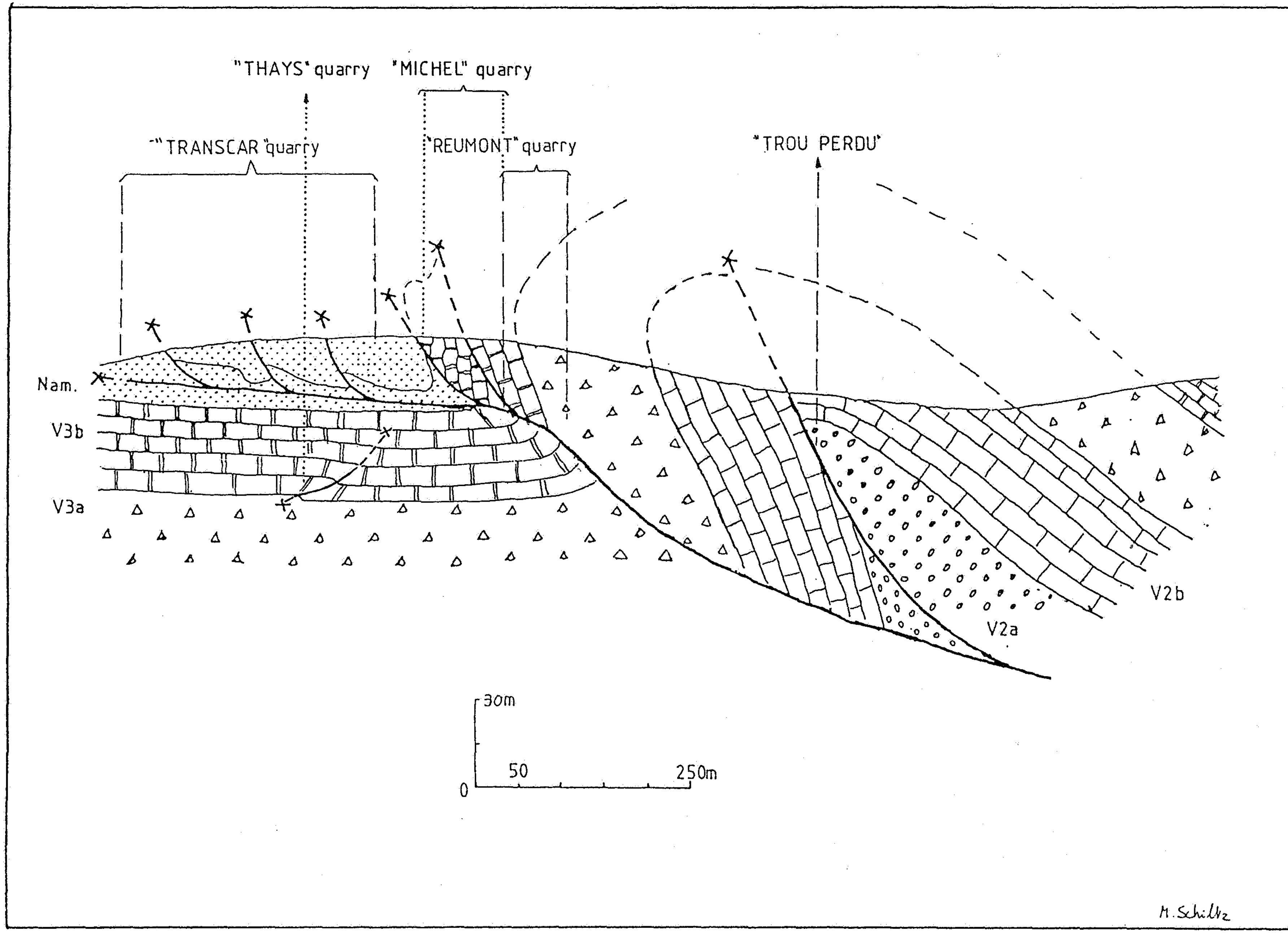

Figure 9. Tectonic interpretation of the "Transcar" quarry and his environment.

CONCLUSION

The "Transcar" area is affected by a major thrustfault cutting through limestone strata ; above the thrustplane in the south, an anticlinal structure is mapped in the core of which a secondary fault is present asymptoticaly merging into the major thrust fault. To the north the thrusting is taken over by a weak bentonite bed in the base of the Namurian along which a minimum of 40 m thrusting is observed. A set of three imbricated secondary faults are associated with this thrust plane in the Namurian. The limestones underneath the thrustplane are in a normal position, almost undisturbed except for some sliding of the layers over each other along thin shaly beds. The backfolding in the limestone suggests another thrustplane deeper under the exposed section.

REFERENCES

BOUCKAERT, J. & HIGGINS, A.C. (1963) - La base du Namurien dans le Bassin de Dinant. *Bull. Soc. belge Géol.*, *70*, 358-375.

BOYER, S.E. & ELLIOT, D. (1982) - Thrust systems. *Bull. Am. Ass. Petrol. Geol.*, *66*, 1196-1230.

CHARLET, J.P. *et al.* (1985) - Les anomalies radiométriques du V3c supérieur du Bassin de Dinant. *Ann. Soc. Géol. Liège*, *108*, 387-399.

DELMER, A. & ANCION, Ch. (1954) - Le Namurien. *In :* Prôdrome d'une description géologique de la Belgique - P. FOURMARIER, 323-352.

DELMER, A. & BOUCKAERT, J. (1977) - Le bassin du Hainaut et le sondage de St Ghislain. *Serv. Géol. Belg., Prof. Paper*, *143*, 12 p.

EK, C. & POTY, E. (1982) - Esquisse d'une chronologie des phénomènes karstiques en Belgique. *Rev. belge de Géogr.*, *1*, 73-85.

JEDWAB, J. (1958) - Présence de Torbernite à Richelle. *Bull. Soc. belge Géol.*, *67*, 300-303.

JEDWAB, J. (1959) - Présence de grès uranifère à Argenteau (province de Liège). *Bull. Soc. belge Géol.*, *68*, 319-323.

LALOUX, M. (1983) - Session extraordinaire de la Société Géologique de Belgique - Guidebook, 53.

LEGRAND, R. (1956) - Brèches radioactives aux environs de Visé. *Bull. Soc. belge Géol.*, *66*, 211-221.

MAMET, B. *et al.* (1986) - La "Grande Brèche" viséenne (V3a) des bassins de Namur et de Dinant est probablement une brèche d'effondrement. *Bull. Soc. belge Géol.*, *95*, *2-3*, 151-166.

MITRA, G. & BOYER, S..E (1986) - Energy balance and deformation mechanisms of duplexes. *Journ. Struct. Geol.*, *8*, *3-4*, 291-303.

NDZIBA, M. (1982) - Anomalies radiométriques des couches de passage du Viséen-Namurien dans le bassin de Dinant. Etude géologique et géochimique. Thèse de doctorat.

PAPROTH, E. *et al.* (1983) - Bio- and lithostratigraphic subdivisions of the Dinantian in Belgium, a review. *Ann. Soc. Géol. Belg.*, *106*, 185-239.

PIRLET, H. (1960) - A propos de la faille de la Carrière Michel à Thon-Samson. *Ann. Soc. Géol. Belg.*, *83*, 199-205.

PIRLET, H. (1963) - Sédimentologie des formations du Viséen supérieur, V3b dans la vallée du Samson. *Ann. Soc. Géol. Belg.*, *86*, *1*, 1-46.

PIRLET, H. (1968) - La sédimentation rythmique et la stratigraphie du Viséen supérieur V3b, V3c dans les synclinoriums de Namur et de Dinant. *Mém. Acad. roy. Belg., Cl. Sc., 2ème série, XVII*, *4*.

QUINIF, Y. & CHARLET, J.M. (1985) - Un événement géochimique du Viséen supérieur dans le Bassin de Dinant. La coupe d'Anhée et ses anomalies radioactives. *Ann. Soc. Géol. Belg.*, *108*, 377-385.

ROUCHY, J.M. *et al.* (1984) - Sédimentologie de la formation anhydritique viséenne du sondage de St-Ghislain. Implicatons paléogéographiques et structurales. *Bull. Soc. belge Géol.*, *93*, *1-2*, 105-145.

RUTTEN, M.G. (1969) - The geology of Western Europe. Elsevier, Amsterdam, 520 p.

STAINIER, X. (1883) - Les failles de Samson. *Ann. Soc. Géol. Belg.*, *18*, 53.

VAN LECKWIJCK, W. (1964) - Le Namurien en Belgique et dans les régions limitrophes. *Mém. Acad. roy. Belg., Cl. Sc., coll. in 4°, série 8, 16 (2)*, 58 p.

WALKDEN, G.M. (1974) - Paleokarstic surfaces in Upper Visean limestones of the Derbyshire Block, England. *Journ. Sed. Petr.*, *44*, *4*, 1232-1247.

WANLESS, H.G. (1979) - Limestone reponse to stress : Pressure solution and dolomitisation. *Journ. Sed. Petr.*, *49*, *2*, 0437-0462.

WRIGHT, V.P. (1982) - The recognition and interpretation of paleokarsts : two examples from the LOwer Carboniferous of South Wales. *Journ. Sed. Petr.*, *52*, *1*, 0087-0094.

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