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DYNAMIQUE SEDIMENTAIRE DU COUVINIEN SUPERIEUR AU FRASNIEN SUPERIEUR DANS LES BASSINS DE NAMUR ET DE DINANT (BELGIQUE, FRANCE)

F. BOULVAIN[1,2] & A. PREAT[2]

(2 figures)

RESUME.- Les analyses sédimentologiques, paléoécologiques et paléontologiques du Dévonien Moyen et Supérieur belge (Préat, 1984, Préat & Boulvain, 1988, Préat & Mamet, 1989) montrent que différents types de plates-formes *sensu lato* se succèdent suivant les variations relatives du niveau marin. On reconnaît ainsi la présence d'une rampe mixte terrigène-carbonatée au Couvinien Supérieur, évoluant par stabilisation progressive du niveau marin et par accrétion littorale en une plate-forme carbonatée à sédimentation rythmique au Givétien. Cette plate-forme est ensuite ennoyée dès le début du Frasnien où on assiste à sa rétrogradation marquée («backstepping»). Son ennoyage définitif a lieu au sommet du Frasnien Moyen où une rampe homoclinale à sédimentation mixte (fig.1) lui fait place. Cette rampe sera, au Frasnien Supérieur, le siège d'une sédimentation uniquement terrigène.

Les changements majeurs de types de plates-formes *s.l.* sont également reflétés par la nature des édifices construits: ceux-ci constituent des «patch reefs» à Coraux et Stromatopores entourés de prairies de Bryozoaires, d'Echinodermes et Algues Udotéacées et Paléosiphonocladales au Couvinien Supérieur, des nappes biostromales à Coraux et Stomatopores massifs ou branchus au Givétien et des monticules micritiques à Eponges et Coraux au sommet du Frasnien. Seuls les faciès internes associés aux plates-formes sont rythmiques avec développement de vastes complexes lagunaires intertidaux à supratidaux de basse énergie. La rythmicité témoigne probablement du jeu de la subsidence et de la productivité carbonatée d'origine bactérienne et algaire (Spongiostromates, Codiacées nodulaires et Kamaénidés). Les faciès internes des rampes sont, par contre de forte énergie, avec développement de «shoals» subtidaux à intertidaux à bioclastes (Couvinien) et à oncoïdes (Frasnien) passant localement à des surfaces émergées (beachrocks couviniens).

L'étude diagénétique des rampes permet, par exemple au sommet du Frasnien, de retrouver les variations les plus importantes du niveau marin avec développement de ciments fibreux pendant les phases de haut niveau marin relatif et de ciments équigranulaires au cours des autres périodes. L'analyse isotopique du carbone et de l'oxygène confirme ces données.

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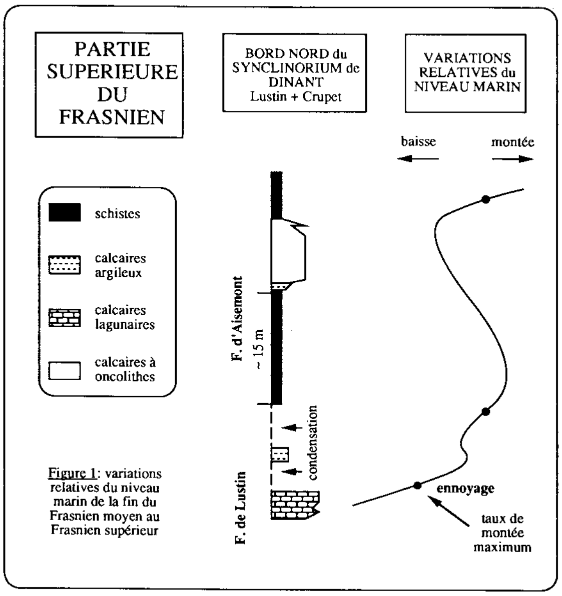

Fig. 1.- Variations relatives du niveau marin de la fin du Frasnien moyen au Frasnien supérieur.

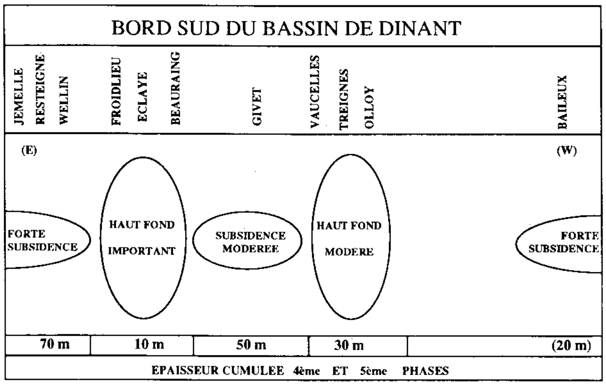

Fig. 2.- Répartition des différents domaines de sédimentation dans la Formation de Trois-Fontaines (Givétien Inférieur) au bord sud du Bassin de Dinant, entre Jemelle à l'est, et Baileux à l'ouest, sur une distance de 60 km.

L'ensemble de ces résultats devrait permettre la mise en évidence des structurations majeures du bassin sédimentaire au Dévonien Moyen et Supérieur: de telles structures existent certainement au Givétien où la sédimentation lagunaire montre d'importantes variations latérales suivant des zones de subsidence différentielle d'une dizaine de kilomètres d'extension maximale (fig.2). Ces zones soulignent probablement des blocs basculés dont l'importance est maximale durant les périodes de stabilité eustatique.

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KINK BANDS FROM THE NEUCHATEAU SYNCLINORIUM FRENCH ARDENNE[1]

DELVAUX de FENFFE Damien[2]

ABSTRACT.- The slates of the southern margin of the Caledonian Rocroi Massif and of the Neufchâteau Synclinorium display three successive sets of kink bands. The cleavage of the slates is formed during the major Variscan deformation, while the kink bands represent a late stage in the Variscan deformational event. A first set consists of millimetric-scale kink bands, intimately related to some minor folds in the Rocroi Massif. A second set has regional importance, with numerous kinks that have developed in the Cambrian and in the Lower Devonian slates. The bands are 1 to 10 cm in width and display constant E-W axial orientation. A third set developed locally, along a SE to SW plunging axis, and shows larger bands generally intersecting the major E-W set.

The geometric characteristics of the second kink set have been studied in detail in several selected areas. The external foliation (Se) dips 70°S at Nouzonville (center of the Neufchâteau Synclinorium). It changes rapidly to 40-25°S near, and inside the southern margin of the Rocroi Massif. This evolution is inherited from the major Variscan deformation. The internal foliation (Si) is systematically less inclined than the external foliation (Se), indicating a normal rotation between Si and Se. Only one set of kink is generally found, with axial-plane dipping 45-70° to the north.

1. Paper announced but not presented during the meeting.

2. Project IGS, Royal Museum for Central Africa, B-1980 Tervuren, Belgium.

Conjugated kinks were only observed at Nouzonville, where the external foliation dips more steeply (70°S).

The kink bands'geometric characteristics can be used to estimate the orientation of the related principal stress axis. The direction of the intermediate stress axis $\sigma 2$ should be parallel to the kink axis, (subhorizontal E-W). The direction of uniaxial compression $\sigma 1$ should be inclined from 10 to 45° more than the dip of the external foliation for the single kink set, and from 0 to 10° more than the dip for the conjugate kink set at Nouzonville. Accepting a uniform stress field over the whole region, this gives mean orientations of N 135°E/70°S for the $\sigma 1$ axis, N 258°E/10°W for $\sigma 2$ and N 352°E/18°N for $\sigma 3$.

In this southern part of the Ardenne, the major Variscan deformation is characterized by E-W folding and boudinage, by southward dipping axial-plane cleavage and a southward plunging mineral extension lineation, contained in the cleavage planes. The intermediate Y-axis of finite deformation is assumed parallel to the E-W boudinage axis, the X-axis (maximum extension) should correspond to the southward-plunging mineral extension lineation (70-25°S) and Z-axis (maximum shortening) is approximated by the pole of the axial-plane cleavage (20-65°N). The formation of late Variscan E-W kink bands should then correspond to a marked change in the deformation regime during Variscan compressional tectonics in this part of the Ardenne. Altough it is not possible to compare principal stress axes and finite deformation axes, it is suggested that the intermediate finite deformation axis keeps his E-W orientation, while the principal plane of finite shortening probably rotated at high angle to the pre-existing cleavage planes.

THE HARD COAL RESERVES OF THE CAMPINE MINING BASIN

M. DUSAR[1], J. BOUCKAERT[1] & P. VERKAEREN[2]

ABSTRACT.- Coal production in Belgium is now restricted to the concealed Campine coalfield in the northeastern part of Belgium.

Exploration for coal was carried out with governement support simultaneously by the mining company «Kempense Steenkolenmijnen» (K.S.) and by the Belgian Geological Survey.

Surface coal exploration by means of seismics and boreholes and carried out in the interval 1979-1988 has brought a wealth of new information on the northern extension of the mining basin. Fifty three boreholes have cored the Westphalian to depths till 1600 m. Seven reflection seismic surveys resulted in ±700 km of profile-lines covering an area of 400 km². Borehole coverage is sufficient in two-thirds of this area (265 km²) with an average of one borehole per 5 km².

These boreholes are unevenly distributed. They were most numerous in areas close to coal mines, assessed for short term reserves evaluation (1 borehole per 2 km²). The borehole density gradually decreases northward and falls below one borehole per 20 km² of seismic exploration zone. Recent prospection campaigns covered only 30 % of the productive Coal Measures Subcrop in the Campine basin.

Coal occurs in hundreds of seams with varying thickness and extension. Only a small number of these seams are exploitable. Mineable reserves can be calculated according to delimiting criteria based on ECE recommendations, applicable to the Campine coalfield. Limiting factors can be specified:

- minimum seam thickness 90 cm
- maximum dirt content 50 weight %
- maximum depth -1200 m
- recovery factor 25 % composed of a factor of 50 % for exploitation losses, and another 50 % for coal seam irregularities.

Coal quality is not considered as a limiting factor since most critical properties do not differ much from the mean values such as 1.15 % sulphur or 3 % ash content and 33500 KJ gross calorific value. (average volatile matter content between 22 and 36 %). Differences in coal rank depend on stratigraphic position and on thermal history of the structural blocks.

The amount of coal present in the underground of the Campine basin is impressive. Previous mostly unpublished estimates of technically recoverable coal in place range from 5000 to 7000 million tonnes of inferred reserves in the Campine coal basin north of the mining district.

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These estimates were based on geological concepts, and were not supported by *in-situ* measurements. It was assumed that the Coal Measures continued beyond the known mining zone with similar characteristics under a progressively thicker overburden. Exploration carried out during the last decade has revealed that there may be a considerable variation in coal content depending on the stratigraphic horizon and the subsidence regime of the different structural blocks.

A more detailed reserve assessment has been applied to the Eisden-North and Neeroeteren-Rotem coalfields and resulted in demonstrated recoverable reserves of 250 million tonnes, or 5 Mio T/km^2. This figure is well comparable both to the mined-out amounts in the collieries and to the mean values established solely from boreholes.

For all recent boreholes the number of potentially exploitable coal seams, their thickness range and tonnage have been noted. These figures then can be related to stratigraphic position and to location within structural blocks.

The most striking results were:

- The limited variability in mean coal seam thickness averaging 123 cm of pure coal, varying only between 118 cm and 128 cm in each major block, with a maximal thickness of 299 cm. This constant behaviour is the legacy of the original depositional environment at the transition of upper delta plain to lower alluvial plain. There is no clear relationship between thickness of individual coal seams and overall coal content.
- The great variability in recoverable reserves, depending on the number of thick seams. The tonnage difference between the richest and the poorest block attains a factor 7. This is mostly due to the great lateral variability in coal content within some stratigraphic sequences, especially in the upper Westphalian.

  This variation is best explained in terms of different subsidence regimes on the various structural blocks coupled with variations in sediment supply at the onset of the Variscan deformation phase.
- Total recoverable coal reserves in the prospected area amount to 835 Mio T representing 3.340 Mio T of coal in place in thick seams.

Additional reserves are present in the collieries, both closed or working and in the seismically explored northfield where no borehole control exists. Inferred resources are furthermore present in the northern Campine-Coal reserves in the Campine thus are largely sufficient to ensure further use as a source of energy.

BIOCLAST ASSEMBLAGES IN THE CRETACEOUS OF WEST FLANDERS, BELGIUM.

P.J. (Sjeuf) FELDER[1]

(3 figures)

ABSTRACT.- The Belgian Geological Survey put at my disposal samples recovered from the boreholes Nieuwkerke (80 samples), Wervik (58 samples), Rekkem (49 samples), Bellegem (5 samples), Rollegem (18 samples) and Bossuit (12 samples) all located in the province of West Flanders, Belgium. The thickness of the Cretaceous in the boreholes decreases from 80 m at Nieuwkerke to about 10 m at Bossuit, about 40 km to the east of Nieuwkerke.

The samples were washed and sieved. Subsequently the bioclasts of the 1-2.4 mm fraction have been analysed. This method has been applied successfully in the Belgian Campine, in the province of Liège and in Dutch Limburg (Felder *et al.*, 1985, Felder & Bless, 1989).

The most complete section was found in the Nieuwkerke borehole (fig.1) in which white chalk with some flints occurs between 89 and 169 m. On the basis of bioclast assemblages this section can be subdivided into three ecozones:

Ecozone 3 (89-114 m), with large numbers of bioclasts and high percentages of Mollusca.
Ecozone 2 (114-132 m), with fewer bioclasts, but higher percentages of Echinoderms.
Ecozone 1 (132-169 m), with fewer bioclasts, but higher percentages of large Foraminifera.

These ecozones can also be recognised in Wervik (ecozone 3, 113-136 m; ecozone 2, 136-148 m; ecozone 1, 148-164 m) and Rekkem (ecozone 3, 110-130 m; ecozone 2, 130-134 m; ecozone 1, 134-146 m). The Bellegem, Rollegem and Bossuit boreholes with a decreased Cretaceous thickness only contain the ecozones 2 and 3 (fig. 2-3).

The ecozones 2 and 3 of Nieuwkerke also occur in the Diksmuide borehole, some 30 km to the north of Nieuwkerke (ecozone 3, 201-218.5 m; ecozone 2, 218.5-232 m). They have been dated Santonian-Coniacian by F. Robaszinsky (pers. comm.). Ecozone 1 has not yet been dated but may be attributed to the Turonian or Coniacian.

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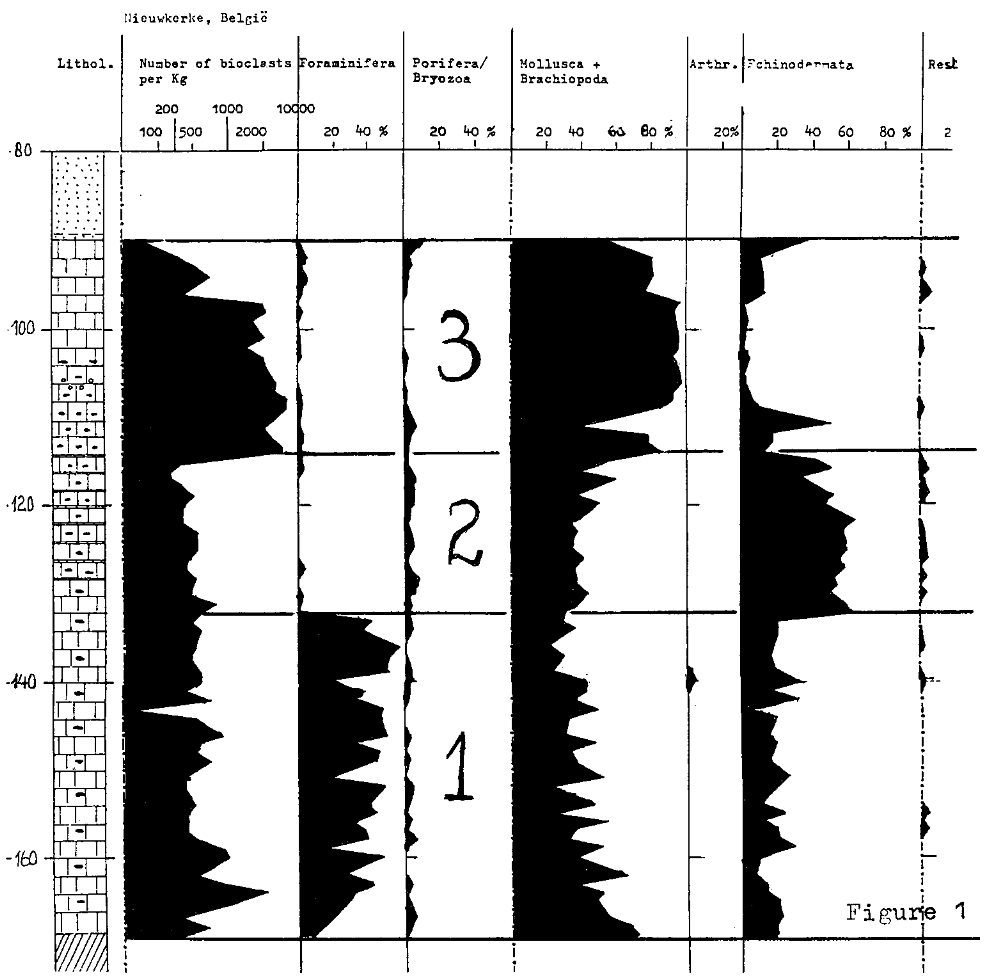

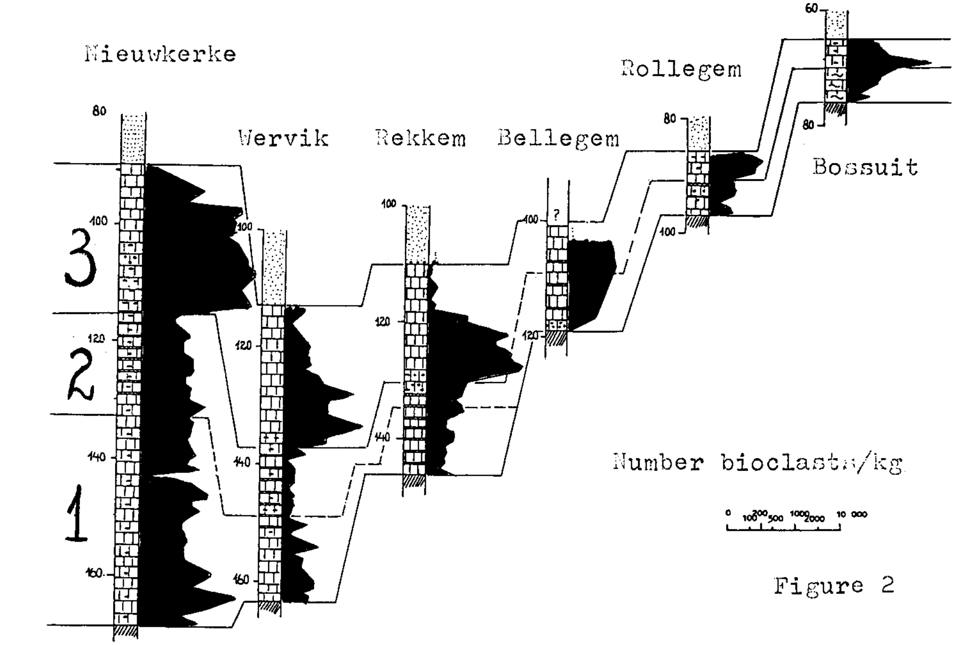

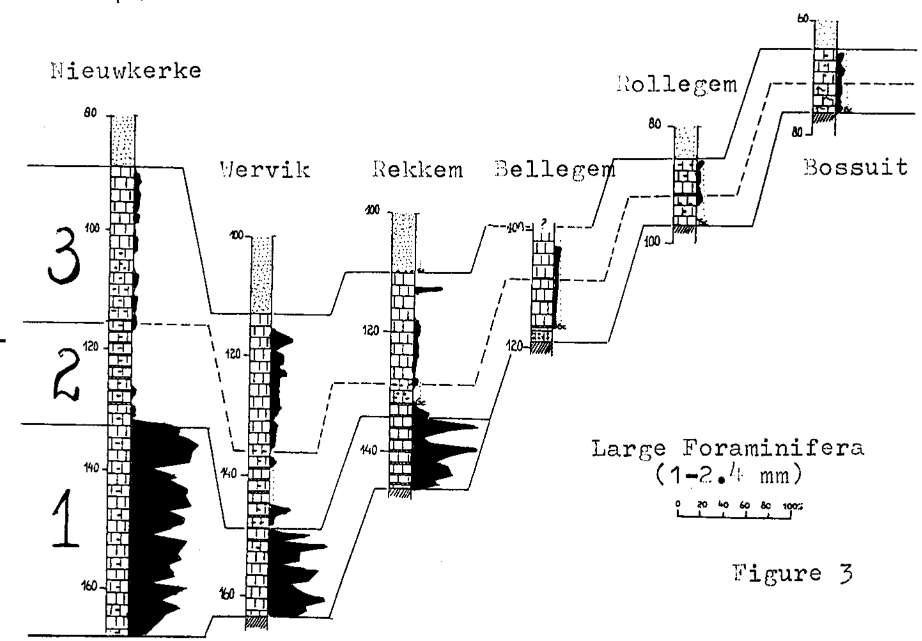

Figure 1.- Cretaceous bioclast assemblages of the Niewkerke borehole. 1-3 Ecozones.

Figure 2.- Correlation of Number-of-large bioclasts/kg profiles in the Cretaceous of West Flanders. 1-3 Ecozones.

Figure 3.- Correlation of percentage profiles of large foraminifera in the Cretaceous of West Flanders. 1-3 Ecozones.

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MATURITY INDICATORS IN THE WESTPHALIAN KEY-WELL KEMPERKOUL-1

W.J.J. FERMONT[1], J.G.M. VAN DE LAAR[1] and H. VELD[1-2]

ABSTRACT.- Well Kemperkoul-1 (South Limburg, The Netherlands) was drilled during a coal-inventory programme that ran from 1982-1986. The borehole yielded an unusual amount of high quality data.

Carboniferous strata between 489 m and 1665 m depth were continuously cored. The age of this interval ranges from Early Westphalian B to Late Westphalian C.The Westphalian sediments are unonformably overlain by Cretaceous and younger sediments.

The Westphalian sediments show an alternation of terrestrial sand, clay and peat, occasionally interrupted by marine or brackish clay, together depicting a paralic facies.

Various depth-related rock-parameters have been analysed. Special attention has been given to the thermal maturity of the organic matter in shales and coals. The vitrinite reflectance values of the Westphalian coals from this well range from 0.65-1.25%Rm. These values coincide with the oil generation window. Volatile matter (VM) decreases from 40% to 27%. The Thermal Alteration Index (TAI) increases from 3.5 to 5.5 over the total Westphalian depth interval. The moisture content decreases from 6% to 1% in this inverval Tmax increases from approximately 430°C to 470°C. There is a relatively small scatter in Tmax values of coals as compared to the shales.

The Hydrogen Index (HI) is generally very low, ranging between 100 and 300 in coals and between 50 and 180 in shales, which confirms the predominantly gasprone type III kerogen character of the coals and shales. The Production Index (PI) is extremely low in the coals, not exceeding 0.06 in coals, and up to 0.20 in shales. These values indicate that the residual petroleumpotential is very low indeed.

The parameters all show distinct interrelations, which allows the establishment of calibration functions. These are considered of importance for the Dutch hydrocarbon exploration activities, in particular because the maturity interval of Kemperkoul-1 (0.6-1.25%Rm) largely covers the oil window. The relative depth dependence of the parameters and their interrelations are statistically quantified by minimum least-squares curve fitting. Third order polynomial regression equations generally yield satisfactory results.

The maturation history of the Westphalian strata is complex. At the end of the Carboniferous the area was deeply buried. The overburden of Westphalian C-D, Stephanian (?) and Permian (?) strata may have been more than 2000 m at Kemperkoul, but is nowadays completely removed. This overburden is either related to an northward areal extention of nappe-like structures from the Variscan mobile belt, or a molasse-like deposition of sediments in front of the Variscan Orogeny. No information is known about the local lithological characteristics of these eroded rocks. Eventual hydrocarbon plays are all removed during subsequent erosion. Extrapolation of the moisture content values to depth makes the occurrence of deep-seated hydrocarbon plays in the area extremely unlikely. There are indications that at or around the time of maximal overburden two major thermal events acted upon the Carboniferous strata of Kemperkoul-1. One distinct coalification pattern in the area is related to the Variscan orogeny during which the Ardennes were formed, somewhat to the south. Towards the north of South Limburg a local magmatic body in the neighbouring German area has influenced the maturity pattern as well. Both events may have taken place somewhere towards the end of the Carboniferous or at the beginning of the Permian. There are also indications that during the time interval between the two thermal events a compressional phase took place that resulted in the formation of a local anticlinal structure, *i.e.* the Visé-Puth anticline. The coalification trends seem

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to cut diachronically through this structure. The spacial distribution of coalification data is currently studied into much greater detail. After the Permian no significant thermal events influenced the deeply eroded, relatively shallow Carboniferous in the area.

CONCLUSIONS

In summary, the most important conclusions of this investigation are:

1. Hydrocarbon generation took place at the end of the Carboniferous.

2. Thermal maturation is related to two events, *i.e.* one directly to the Variscan orogeny, the other to a magmatic (?) body in the north-east.

3. The coals and shales acted as gas-source rocks.

4. Reservoirs and scals are removed during (post-)Permian erosion.

5. No secundary gas-generation occurred after the Permian.

6. The residual potention for oil is extremely low.

7. The coalification data indicate an extreme overburden, related to the Variscan orogeny. Two models are proposed: One model postulates a northern extension of the Variscan nappe structures. The second model postulates a molasse-deposit north of the Variscan belt.

SPINES IN LOWER DEVONIAN PLANTS, AN EXPLANATION ?

Ph. GERRIENNE[1] & M.J.M. BLESS[1]

(3 figures)

ABSTRACT.- Many Lower Devonian plants bear epidermic protuberances known as «spines» or «emergences». Typical examples are *Sawdonia* (fig.1), *Crenaticaulis* (fig.2) and some species assigned to *Psilophyton* (fig.3), as well as at least three new taxa recently discovered in Belgium (Gerrienne, 1990).

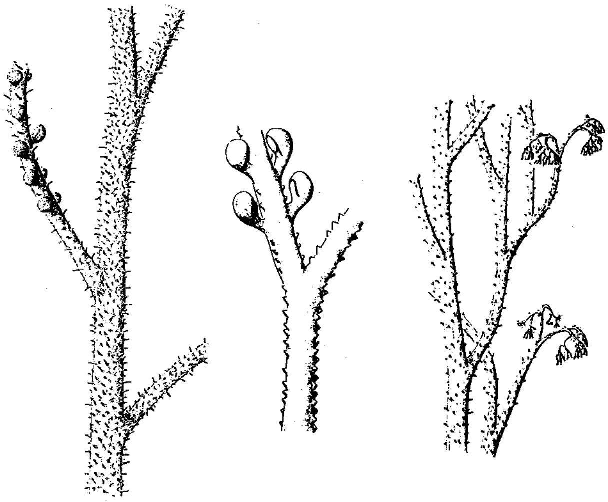

Fig. 1.- *Sawdonia acanthotheca* Gensel, Andrews & Forbes
Fig. 2.- *Crenaticaulis verruculosus* Banks & Davis
Fig. 3.- *Psilophyton princeps* Dawson

Several explanations have been forwarded for the occurrence of theses spines:

- They increase the epidermal surface and allow a better respiration (photosynthesis). Thus they may represent the onset of an evolutionary process leading to the microphyllous leaf.
- The spines were meant as a self-defence system against predators (Molluscs, Acaridans, etc.).

The three following observations form the basis for an alternative hypothesis:

- The stability of mine galleries can be improved considerably by slim boreholes perpendicular to the direction of the main gallery. Also roof bolts consisting of the same material as the roof support enhance the stability of these galleries.
- When trees break down in a storm, the fracture is usually located in that part of the trunk which is devoid of branches. Apparently, branches deflect and lessen the force of the wind.
- Along numerous beaches and riversides, sticks are driven into the ground in order to deflect the strength of waves and currents and to diminish erosion.

We suggest that the first vascular plants used spines in a similar way, i.e. to moderate the pressures of (alternating) winds, waves and

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currents. This implies that spiny Lower Devonian plants may represent a special adaptation to frequently (or seasonally ?) flooded river sides and banks. If this suggestion is correct, the relative abundance of spiny plants can reflect a repeatedly high energy paleoenvironment in a fluvial/deltaic system.

ABOUT THE USE OF GIS FOR GEOLOGICAL PURPOSES

I. HALLEUX[1]

ABSTRACT.- The geologist has to solve spatially distributed problems (logs description, cross-section, correlation, ore estimation, etc.), and thus requires elaborate software possibilities. He needs topological and attribute databases, for an accurate digital description of the data, but also procedures and techniques for data management and spatial analysis as well as elaborate display facilities.

The database structure, beyond the usual functionalities of structure flexibility, friendly coding, correcting and editing, etc. must be 3D architectured and must offer large text facilities. Besides algorithms for data classification and selection, networking and overlay, the system has to be able to integrate soft information, to take into account the spatial reference (through geostatistics, for instance) and to propose typical geological procedures (stereographic projections, fence-diagrams, 3D models, ...).

Using Geographic Information Systems (GIS) for geological purposes is a realist solution. The young and expanding market offers global and dedicated versions, running on PC or workstations. However, for very pointed problems like the geological ones, a unique solution is uncommon, even non-existant. The softwares are fortunately open and the geologist, through the combination of well choosen programs, can find directly and fully operational systems.

At the Natural Resources Department of INIEX, GIS are commonly used for practical purposes. The example of an actual research will be given, which show the interest but also the software requirements of GIS; it concerns the thematic mapping of the exploitation potentialities of the «Petit Granit» in Belgium.

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STRIKE SLIP DEFORMATION IN THE STAVELOT MASSIF

F. GEUKENS[1]

ABSTRACT.- The Stavelot Massif can be divided into a northern part with a NE-SW (hercynian) direction and a southern part characterised by a E-W (caledonian) tectonic style.

These two parts are separated by a left hand (N50-60°E) strike slip fault system just south to the Malmedy Graben.

The movements along this fault system can be seen in the tectonic structure of the southern part, viz: a window structure at Falize-Ligneuville, a very complicated structure at Trois Ponts, and the typical bending of the dipping Rv5 anticline at He de Hierlot.

This strike slip fault may also be responsible for the extension of the Lower Devonian near Jevigné.

The north east prolongation of this strike slip fault passes through the seismic centre of Robertville.

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RECENT CONTRIBUTION TO TEPHROSTRATIGRAPHY BETWEEN THE EIFEL AND THE FRENCH MASSIF CENTRAL

E. JUVIGNE[1]

ABSTRACT.- Using microprobe analyses of minerals, creteria have been established for the identification of tephras which occur in Middle and High Belgium, and also in the Vosges/France: the Laacher See Tephra (11.000BP), the Eltville Tephra (16.000BP), and the Rocourt Tephra (between 62.000 and 106.000BP).

1. Chercheur qualifié du F.N.R.S., Laboratoire de Géomorphologie et de Géologie du Quaternaire, Place du XX Août, B-4000 Liège.

Since glass shards have not been found in several localities in the investigated regions, the most recent tephra was attributed either to boreal trachytic eruptions in the Chaîne des Puys (French Central Massif), or to the Allerod phonolithic eruption of the Laacher See (Eifel). The clinopyroxenes of the Laacher See Tephra are more calcic than those of the trachytic eruptions of the Chaîne des Puys. The composition of titanite is also quite different in each tephra. Therefore the only recent tephra layer in the Vosges and in High Belgium must be correlated with the Laacher See Tephra.

A basic tephra layer which was found in loess profiles of Belgium and The Netherlands was correlated previously with the Eltville tephra which is well known in central Germany. This correlation was contested using stratigraphical criteria. Recently it has been demonstrated that the clinopyroxene and olivin respectively have identical chemical composition throughout the lobe.

For the last 40 years, enstatite is considered as the guide mineral of the widespread Rocourt Tephra. Since enstatite is only known in ultrabasic magma, its optical determination has been doubted by some authors. Microprobe analyses firmly proved the presence of enstatite in the tephra so that it can be used as guide mineral for the relevant volcanic material.

BIOSTRATIGRAPHICAL CORRELATION BETWEEN THE HANGENBERG SCHIEFER (NORTHERN «RHEINISCHES SCHIEFERGEBIRGE») AND GLACIGENIC DEPOSITS IN BRAZIL

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ABSTRACT.- Clastic sedimentary sequences with glacigenic characteristics of Late Devonian age are described in several basins of Brazil. They were dated as Famennian *sensu lato.* Samples from these sequences in the Amazonas and Parnaiba basins contain well preserved miospores which allow a accurate correlation with the uppermost Famennian (Middle *praesulcata* Zone equivalent) *R. lepidophyta - H. explanatus* and *R. lepidophyta - V. nitidus* Zones (LE and LN Zones). The same miospore-zones characterize the Hangenberg Schiefer and Sandstein in the Northern «Rheinisches Schiefergebirge» which are considered to correspond to a sudden drop of sea level. Such an accurate time relationship between glacigenic sediments in Brazil and drop of sea-level in Germany (and around the world !) suggests that they might have the same climatic origin.

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DEUX SONDAGES A MALMEDY

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SITUATION DES SONDAGES

MALMEDY I

INTERMILLS, route de Robertville; X=267.851, Y=126.078, Z=+338,443m, archivé 169E/379; profondeur atteinte: 200m.

MALMEDY II

EMBRANCHEMENT AUTOROUTIER DE WAVREUMONT. X=265.210, Y=123.672, Z=+395,256m' archivé 160W/928; profondeur atteinte: 200m.

NIVEAUX LITHOLOGIQUES TRAVERSES PAR «MALMEDY I»

De 0,00 à 4,00m :

Alluvions de la Warche.

De 4,00 à 38,36m :

Formation moyenne des Poudingue de Malmédy (F. à galets de calcaire). Les éléments calcaires ont été attribués au Couvinien, au

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Givetien, au Frasnien et au Famennien. La coloration des conodontes (index 1 à 1,5) démontre que les massifs géologiques «sources» des galets n'ont jamais été profondément enfouis (A.S.).

De 38,36 à 97,63 m :

Formation inférieure des Poudingues de Malmédy.

De 97,63 à 200,00 m :

Socle calédonien (phylades noirs, pyriteux et quartzites, attribués au Révinien moyen par M. Vanguestaine). Quelques veinules de quartz traversant dans les quartzites contenaient une association minéralogique «quartz-Au-Bi«Fe-Pb-As-S» (F.D. et Ph. A.).

Une source artésienne, un «pouhon», a été recoupée à la profondeur -135m. Une forte déviation temporaire des enregistrements «rayon gamma» a mis en évidence la diffusion de gaz radon hors du socle calédonien.

NIVEAUX LITHOLOGIQUES TRAVERSES PAR «MALMEDY II»

De 0,00 à 181,32 m :

Formation inférieure des Poudingues de Malmédy (totalement dépourvue de galets calcaires).

De 181,32 à 205,00 m :

Quartzite et phyllades attribués au Révinien inférieur (Rn1a) (M.V.).

Dans les deux sondages, la formation inférieure de Malmédy débute par des brèches accumulées probablement en pied d'escarpements de failles actives. Cette formation présente une nette augmentation de puissance entre Malmédy I (60 m) et Malmédy II (181 m). Le sommet du socle calédonien est rubéfié sur au moins 10 mètres.

Plusieurs niveaux de bentonite potassique (ancienne cinérite) ont été mis en évidence; de ce fait le dépôt «malmédien» présente de fortes similitudes avec le «Rotliegendes inférieur».

Les études sédimentologiques permettent de supposer que les formations de Malmédy furent déposées dans un fossé tectonique actif; ceci expliquerait l'anomalie de puissance découverte à Wavreumont. Ce bassin fut le réceptacle, en climat aride, de sédiments grossiers édificateurs d'un «fan alluvial».

Les formations de Malmédy ne peuvent être datées avec certitude. Les conditions sédimentologiques, les études paléomagmatiques (Y. De Magnée, 1962) laissent à supposer qu'un âge Permien est acceptable.

OROGENIC DEFORMATION OF THE WESTERN RHENISH MASSIF

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ABSTRACT.- A cross section of the western Rhenish Massif is currently investigated by research groups of the universities of Aachen, Bonn and Würzburg. Investigations are carried out between the Wurm syncline north of Aachen and the Hunsrück-Südrand fault in the south. Aim of the project is to analyse the structural development covering basin extension, orogenic compression and postkinematic extension. This shall be achieved by constructions of deep reaching profiles and their balanced restoration.

Profile balancing is only possible on the condition that internal rock deformation is known. Therefore the finite strain is measured throughout the entire area of investigation. The choice of the appropiate method of strain analysis (Fry, $R_f/\varnothing$) depends on the effective deformation mechanism. Results show relatively constant strain values in fold structures. Also local strain variations due to changes in lithology mostly stay below 0.3. With aproximation to major thrusts in the Hunsrück area a possible increase of the R_{xz} strain from $<$ 1.5 to $>$ 2.5 can be recorded.

Strain data reveal for the area of the northern Eifel only weak internal deformation with R_{xz} = 1.2 - 1.4 (internal shortening in relation to the profile strain ellipse, constant volume supposed: 8-22 %). The Metamorphic-Zone along the southern border of the Stavelot-Venn-Massif exhibits values of R_{xz} $>$ 3 (internal shortening: 30-47 %). The internal deformation of the Eifel North-South-Zone is only of compactional nature. In its southeastern continuation the mean R_{xz}-strain increases towards the South through the Southeast-Eifel and the Hunsrück area from 1.2 to 1.7. Finally the ductil sheared and imbricated strata of the southern Hunsrück show R_{xz} values till 3.0 (internal shortening up to 47 %).

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According to the strain data internal deformation is predominantly of plane to prolate character (k >/= 1). An internal elongation of the «Schiefergebirgsstockwerk» is recognizable. This stretching (max.: 60 %) acted in the plane of the slaty cleavage in direction of the tectonic transport. Evaluations of the synorogenic changes in strata length mostly yielded elongations (e.g. Stavelot-Venn: 16 %, Südhunsrück: 33 %).

As a consequence the effective shortening of the crust results from folding and tectonic stacking.