

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

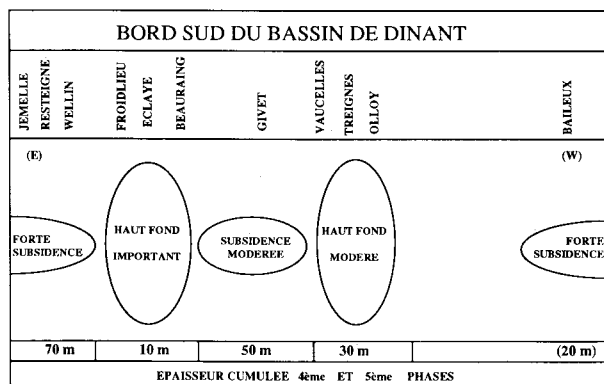


Fig. 2.- Répartition des différents domaines de sédimentation dans la Formation de Trois-Fontaines (Givétien Inférieur) au bord sud du Bassin de Dinant, entre Jemelle à l'est, et Baileux à l'ouest, sur une distance de 60 km.

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.

### BIBLIOGRAPHIE

PREAT, A., 1984. Etude lithostratigraphique et sédimentologique du Givétien belge (Bassin de Dinant). *Thèse Doct. Université Libre de Bruxelles*, 466 p.

PREAT, A. & BOULVAIN, F., 1988. Middle and upper Devonian carbonate platform evolution in Dinant and Namur Basins (Belgium, France). *I.A.S. 9th European regional Meeting, Excursion guidebook, Leuven, sept. 1989*: 1-25.

PREAT, A. & MAMET, B., 1989. Sédimentation de la plateforme carbonatée givétienne franco-belge. *Bull. Centres Rech. Explor.-Prod. Elf-Aquitaine*, 13(1): 47-86.

## KINK BANDS FROM THE NEUCHATEAU SYNCLINORIUM FRENCH ARDENNE<sup>1</sup>

DELVAUX de FENFFE Damien<sup>2</sup>

**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. Although 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<sup>1</sup>, J. BOUCKAERT<sup>1</sup>  
& P. VERKAEREN<sup>2</sup>

**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 government 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  $\pm 700$  km of profile-lines covering an area of 400 km<sup>2</sup>. Borehole coverage is sufficient in two-thirds of this area (265 km<sup>2</sup>) with an average of one borehole per 5 km<sup>2</sup>.

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 km<sup>2</sup>). The borehole density gradually decreases northward and falls below one borehole per 20 km<sup>2</sup> 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.

1. Belgian Geological Survey, Jennerstr. 13 - 1040 Brussels.

2. K.S. A.K.D., Koolmijnlaan, 351 - 3540 Heusden-Zolder.