Annales de la Société Géologique de Belgique, T. 112 (fascicule 1) - 1988, pp. 247-253 Août 1989

AACHEN-LIEGE UNIVERSITIES EXCHANGE DAYS IN AACHEN NOVEMBER 27th, 1987

Organized by R. WALTER, RWTH Aachen,
E. POTY & M. STREEL, Paleontology, University of Liège

in cooperation with the Société géologique de Belgique, Liège
and the Natural History Museum, Maastricht

Thema : ASSESSMENT OF PALEOGEOGRAPHIC DISTANCES : IMPLICATIONS FOR APPLIED GEOLOGY

THE LATE CRETACEOUS BETWEEN ANTWERP AND AACHEN : DIFFERENTIATION IN SEDIMENTARY FACIES AS A RESPONSE TO TECTONIC ACTIVITY

Martin J.M. BLESS[1]

1 Natuurhistorisch Museum Maastricht.

Reappraisal of biostratigraphy data on the Upper Cretaceous deposits between Aachen (FRG) and Antwerp (Belgium) learns that these do not represent an uninterrupted, continuous succession of sediments. On the contrary, there is evidence for frequent and even considerable hiatuses which are interpreted as a response to local differential warping of the intensely block-faulted basement. Moreover, in contrast to former opinions, there are good biostratigraphic tools (belemnites, ammonites, foraminifera, ostracodes, bioclast assemblages) demonstrating the strongly diachronic character of sedimentary facies. For instance, the lower half of the white chalk (Zeven Wegen Chalk) of the Upper Campanian at Halembaye (CPL Quarry of Haccourt) and Maastricht (Kastanjelaan and Heugem boreholes) is absent in the intermediate area of Lixhe and 's-Gravenvoeren and passes into a glauconitic, sandy marl to the north (Bunde borehole; cf. Herngreen *et al.,* 1986), north east (De Dael outcrop near Heerlen) and east (Hombourg borehole and Zeven Wegen outcrop; cf. Jagt *et al.,* 1987). These lateral changes in lithofacies are so «dramatic» and take place over so extremely short distances that, until recently, nobody accepted that these might be coeval. These differences are now explained by synsedimentary tectonics, long-shore currents and other sedimentary models (Bless *et al.,* 1987).

This example shows that contrasting lithologies or fossil assemblages do not yield a clue for identifying their original distance or nearness.

BLESS, M.J.M., FELDER, P.J. & MEESSEN, J.P.M.Th., 1987. Late Cretaceous sea level rise and inversion : their influence on the depositional environment between Aachen and Antwerp. *Ann. Soc. géol. Belg.,* 109 : 333-355.

HERNGREEN, G.F.W., FELDER, W.M., KEDVES, M. & MEESSEN, J.P.M.Th., 1986. Micropaleontology of the Maestrichtian in borehole Bunde, the Netherlands. *Rev. Palaeobot. Palynol.,* 48 : 1-70.

JAGT, J.W.M., FELDER, P.J. & MEESSEN, J.P.M.Th., 1987. Het Boven-Campanien in Zuid-Limburg (Nederland) en Noordoost België. *Natuurhist. Maandblad Limburg,* 76 (4) : 94-110.

THE ORDOVICIAN OF BRITANNY AND PORTUGAL, SIMILAR SEDIMENTARY SEQUENCES DEPOSITED SEVERAL HUNDREDS OF KILOMETERS APART

Martin J.M. BLESS[1]

1 Natuurhistorisch Museum Maastricht.

The Ordovician deposits of Britanny and Portugal show a remarkable similarity in the succession of lithologies and their thickness (tab. 1).

Table 1.- Comparison between the Ordovician rocks of the Presqu'île de Crozon (Britanny) and The Serra de Buçaco (Portugal), after Henri *et al.,* 1974.

AGE	CROZON (BRITANNY)	BUÇACO (PORTUGAL)
Ashgill	Rosan Formation (tuffs and lavas)	Porto do Santa-Anna Fm. (tuffs and lavas)
	Kermeur Formation (alternating micaceous siltstones and quartzitic sandstones) thickness : max. 300 m	Louredo Formation (alternating micaceous siltstones and quartzitic sandstones) thickness : max. 250 m
Llandeilo Llanvirn	Postolonnec Formation (micaceous siltstones intercalated by quartzitic sandstones; fine-grained siltstones in lower quarter) thickness : 300-350 m	Cacemes Formation (micaceous siltstones intercalated by quartzitic sandstones; fine-grained siltstones in lower third) thickness : 300 m
Arenig	Grès Armoricain (thick-bedded quartzitic sandstones with in upper portion micaceous sandstones thickness : 100-1000 m	Grès Armoricain (thick-bedded quartzitic sandstones with in upper portion micaceous sandstones) thickness : 400-700 m

Also the fossil assemblages (notably those of the Postolonnec and Cacemes Formations) are very similar as far as chitinozoans, ostracodes and trilobites are concerned. This was noticed already in 1901 by Kerforne, who wrote: ... «les listes de fossiles de Vallongo et de Bussaco données par M. Delgado (loc. cit.) semblent être des listes de localités armoricaines.» Henri *et al.* (1974) noticed that there is not only a qualitative but also quantitative similarity between these fossil assemblages.

This example demonstrates that the depositional history of rather distant regions (even if we take into account their original paleogeographical position during the Ordovician) may be almost the same. In this case this is true for a succession of sedimentary environments and their life conditions. In other cases, there is an astonishing alikeness of lithofacies and their fossil contents during a relatively short period, for instance the regularly observed black shale deposits (often interpreted as «event» deposits).

These examples prove that the similarity in lithologies and fossil contents is not a clue for the recognition of relative nearness or relative distance.

HENRI, J.L., NION, J., PARIS, F. & THADEU, D., 1974. Chitinozoaires, ostracodes et trilobites de l'Ordovicien du Portugal (serra de Buçaco) et du massif Armoricain : essai de comparaison et signification paléogéographique. *Com. Dos Serviços Geol. Portugal,* 57 : 303-345.

KERFORNE, F., 1901. Etude de la région silurique occidentale de la presqu'île de Crozon. Thèse Univ. Rennes : 234 p.

THE WESTPHALIAN C IN THE CAMPINE BASIN : COAL CONTENT INFLUENCED BY TECTONICS

M. DUSAR[1]

1 Geologische Dienst van België, Brussel, Belgium.

INTRODUCTION

In the northeastern part of the Campine coal basin in Belgium, coal exploration by means of reflection seismics and coreholes carried out between 1979 and 1985 has yielded new information on the terminal coal bearing strata of Upper Westphalian C - Lower Westphalian D age. The Westphalian coal measures in the Campine basin have been deposited in an upper delta plain environment. However the average coal content may vary considerably for sequences of similar age event on very short distances. This variation in coal content cannot be explained in terms of dynamic depositional models only. In some instances synsedimentary block faulting may have led to different subsidence patterns influencing the facies distribution. Tectonic control of subsidence rates and coal distribution may be fairly widespread as proposed by Fielding (1987). Bless *et al.* (1977) emphasized the importance of sediment thicknesses for the paleogeographical reconstructions of the northwest european coalfields.

STRATIGRAPHY

In the Campine basin Westphalian C-D strata attain a maximum thickness of $\pm$ 1425 m, composed of $\pm$ 400 m for the Lower Westphalian C (between the Aegir or Maurage marine band and Tonstein Nibelung), $\pm$ 475 m for the Upper Westphalian C (between Tonstein Nibelung and the base of the Neeroeteren Sandstone), and $\pm$ 550 m for the «Westphalian D» (above the base of the Neeroeteren Sandstone, 300 m cored in borehole 146 Neerglabbeek, 250 m added from seismic data). The occurrence of *Neuropteris ovata* which should indicate the international base of the Westphalian D, about 50 m below the base of the Neeroeteren Sandstone has not been confirmed by recent paleobotanical studies (comm. G. Borremans). Further stratigraphic subdivisions were proposed by Paproth *et al.* (1983). Guidelines for seam to seam correlation within this sequence were provided by Dusar *et al.* (1985).

TECTONIC CONTROL OF SUBSIDENCE

Five boreholes drilled for the coal exploration programme of the Belgian Geological Survey have traversed the Westphalian C/D sequence in the northeastern Campine. Maximal distance between these boreholes is 8 km in a direction parallel to the graben margin and to the main Jurassic-Tertiary faults (fig.). Correlation between boreholes which fit in the general stratigraphic framework become problematical from southeast to northwest. The coal content and coal reserves in potentially exploitable coal seams diminish in the same direction.

Differential subsidence of adjacent structural blocks rather than lateral differences in a wandering depositional environment probably forms the dominant control mechanism for the observed variation (Bouckaert & Dusar, 1987). The limits between these blocks represent ancient lineaments already affecting the Cambro-Silurian basement of the Brabant Massif. The Gruitrode lineament which crosses the exploration area southeast of borehole 169 represents a major block margin.

In this way each structural block can be considered as a small rather homogeneous coalfield with comparable sequence (e.g. boreholes 161 and 168). Individual coal seams may vary in thickness or present splitting phenomena. However coal seam groups and reserves estimates for thick coal seams will remain more constant.

It is also noteworthy that differential subsidence varied considerably in time leading to standstills or to inversions in sedimentation rate (fig.). A thickness reduction by one third for the Upper Westphalian C on the northwestern block is mostly absorbed, without faults, near its base (deposition time of the Rubezahl - Tristan coal seam groups according to the German stratigraphic nomenclature). In this interval no correlations are possible. It is also shown that limnic facies types are more widespread in roof shales of the northwestern bloc (70 %) than of the southeastern block (45 %). Also the distribution of channel or crevasse splay sandstones is very uneven.

In the Lower Westphalian C thick coal seams are again very prominent on the block (borehole 172) which shows no prospect for exploitation in the Upper Westphalian C.

CONCLUSIONS

With respect to the symposium theme, observations from the Upper Carboniferous in the Campine basin imply that prediction of paleogeographic distances from purely sedimentary models is unreliable since synsedimentary tectonic activity has controlled subsidence regimes and hence coal content. The synsedimentary structural blocks are delimited along reactivated basement faults. The observed structures and facies changes are certainly not unique for the Brabant Massif and the Campine basin.

REFERENCES

BLESS, M.J.M., BOUCKAERT, J., CALVER, M.A., GRAULICH, J.M. & PAPROTH, E., 1977. Paleogeography of Upper Westphalian deposits in NW Europe with references to the Westphalian C North of the mobile Variscan belt. *Meded. Rijks Geol. Dienst,* NS 28/5 : 101-127.

BOUCKAERT, J. & DUSAR, M., 1987. Arguments géophysiques pour une tectonique cassante en Campine (Belgique), active au Paléozoïque supérieur et réactivée depuis le Jurassique supérieur. *Ann. Soc. géol. Nord,* CVI : 201-208.

DUSAR, M., MEYSKENS, M., BLESS, M.J.M., SOMERS, Y. & STREEL, M., 1985. The Westphalian C-D strata in the northeastern Campine. Possibilities for seam to seam correlations. *Ann. Soc. géol. Belg.,* 108 : 412-413.

FIELDING, C.R., 1987. Coal depositional models for deltaic and alluvial plain sequences. *Geology,* 15 : 661-664.

PAPROTH, E., DUSAR, M., BLESS, M.J.M., BOUCKAERT, J., DELMER, A., FAIRON-DEMARET, M., HOULLEBERGHS, E., LALOUX, M., PIERART, P., SOMERS, Y., STREEL, M., THOREZ, J. & TRICOT, J., 1983. Bio- and lithostratigraphic subdivisions of the Silesian in Belgium, a review. *Ann. Soc. géol. Belg.,* 106 : 241-283.