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INTRODUCTION TO THE INTERNATIONAL MEETING ON THE CALEDONIDES OF THE MIDLANDS AND THE BRABANT MASSIF.

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The Brabant Massif is a mostly concealed Caledonian fold belt, underlying 38% of the Belgian territory, with fortunately outcrops in its southern part. It was studied increasingly over the last forty years. Its westward prolongation however remained unknown by lack of borehole information under the North Sea. Tentatives to connect the "Caledonian folded" Brabant Massif with the Caledonides in Wales or the Lake District, had to emphasize a large detour northward of the Charnwood-The Wash Precambrian "island", or southward around the Midlands Microcraton or no connection at all.

T.C. Pharaoh, R.J. Merriman and co-workers questioned in 1987 the presence of that Precambrian "island" in the subsurface NE of the Midlands Microcraton, from Charnwood to The Wash. Their studies of geochemistry and illite crystallinity led them to postulate instead a major NW-SE trending structure of Lower Palaeozoic age. They named it the concealed Caledonides of eastern England. It allowed a straight connection of the Brabant Massif with the Lake District and further on with the Caledonides via this concealed fold belt under eastern England. If the latter connects under the North Sea with the Brabant Massif than it represents a major structural unit in NW Europe (500 km long by 50 to 150 Km wide), comparable in size with the Variscides in the "Rheinish Schiefergebirge" and Ardennes combined.

In april 1988 a first, informal, international field meeting was held in both the Midlands (U.K) and Belgium, attended by some twenty persons. It was the start of a growing collaboration between many workers to compare the largely concealed Caledonian fold belts in Eastern Anglia and in Belgium and to trace their possible connection. It was decided to organize another meeting to test this hypothesis, by bringing workers together from both areas to compare their data and results.

That second international meeting, the "International Symposium on the Caledonides of the Midlands and the Brabant Massif" was held in Belgium between 20 and 23 september 1989, with a symposium day of oral communications and poster sessions in the auditoria of the Royal Belgian Institute for Natural History (Brussels). It was preceded by a pre-symposium excursion to the post-Caledonian block faulting on the eastern border of the Brabant Massif in the Devonian-Carboniferous of the Visé area, and followed by two days of excursion on the stratigraphy and magmatism in the Brabant Massif. Some hundred persons from seven countries attended the meeting and field excursions. This volume contains the proceedings of selected papers presented at that Symposium, together with the guidebook to the excursions in the Brabant Massif.

The name of the symposium was unluckily called the Caledonides of the "Midlands" and the Brabant Massif. In the eastern Midlands the Lower Palaeozoic rocks are however unfolded and resting on the Precambrian Midlands Platform or Microcraton. They are folded more to the NE, in the subsurface of East Anglia or eastern England. The error has been rectified by calling the next meeting (Nottingham, U.K., september 1992) the "Early Palaeozoic history of the Anglo-Brabant Massif and adjacent Caledonides". The aim of that meeting will be to further evidence and characterize this Caledonian fold belt and give it a formal name.

The often used term London-Brabant Massif is for two reasons unsatisfactory to indicate the NW-SE trending Caledonian fold belt under East Anglia and in the Brabant Massif. First is the city of London situated above Devonian rocks and well south of the fold belt.

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Secondly, the term was used to indicate the positive emerging area during different phases from Late Palaeozoic until the Cenozoic. It was used in the sense of a dome or a "high" and not in the sense of a fold belt or a "massif".

This volume of proceedings contains a variety of articles, from comparisons between both areas Anglia or Brabant, or areas more to the west and the east, reviews of existing knowledge, new data obtained by specific methods in a larger region or topical information of a smaller area. The articles incorporated in this volume, follow the same order.

Comparison between Anglia and Brabant

N.H. Woodcock compares the eustatic and tectonic controlled unconformities observed in the Welsh basin with the other side of the Midlands Microcraton, the Anglian basin and with its probable prolongation the Belgian Caledonides. He describes similarities and differences between the Anglian and the Welsh basins using stratigraphical, facies, structural and metamorphic criteria, and characterizes more in detail the Anglian basin.

Germany

B.-D. Erdtmann shifts the attention to the eastern extension of the Anglo-Brabant Massif. He presents new data on the post-Cadomian to earliest Silurian of both western and eastern Germany. It testifies the presence of many microplates with similarities or differences from the Anglo-Brabant Massif.

United Kingdom

M.K. Lee, T.C. Pharaoh & C.A. Green present the gravity and aeromagnetic fields in eastern England as colour and grey-tone shaded-relief images in more detail than previous studies on the entire U.K. Their lineaments and correlations of anomalies define the dominantly SE and ESE structural trends of the basement. This study constitutes a new argument for the relation between the concealed fold belt under eastern England and the Brabant Massif.

T. C. Pharaoh, J.A. Merriman, J.A. Evans, T.S. Brewer, P.C. Webb & N.J.P. Smith studied the geochemistry and petrography of felsic extrusives from deep boreholes in eastern England. Their isotope studies suggest a mid to late Ordovician age. They postulate that an Ordovician sub-aerial calc-alkaline volcanic arc extended from the Brabant Massif under eastern England to the Lake District, developing in response to the closure of the Tornquist Sea convergence zone. A few boreholes in the southern Midlands Microcraton encountered mafic lavas and intermediate tuffs of Llandovery or earlier age believed to form part of a EW-trending volcanic suite of an early Silurian age along the northern edge of the concealed Variscan Front in England.

S.G. Molyneux reviews all early Palaeozoic boreholes of eastern England which contained fossils. The palaeontological evidence from published and own data is described in detail together with its facies, and support the idea of a fold belt lying to the east of the Midlands microcraton.

J. Lovell, S. Crampin & T. Shepherd demonstrate with different examples that it is possible to determine the stress direction in variety of tectonic environments throughout the upper 10 to 20 km of the Earth's crust. They analyze all suitable recordings of three-component seismic data, from both earthquake and man-made sources. Shear-waves display characteristic shear-wave splitting with preferential directions of polarization seemingly following aligned, parallel, vertical, liquid-filled inclusions. Analyzing these shear-waves allows to determine the maximum horizontal compressive force causing the orientation. It is suggested that the knowledge of these stress directions in NW Europe could considerably be improved by such analysis.

Belgium.

Precambrian rocks are not considered to be present at the Belgian surface or subsurface. In continuation of previous studies (André & Deutsch, 1984; André, Deutsch & Hertogen, 1986), L. André presents here nonetheless his arguments for the presence of a Precambrian crystalline basement under the Brabant Massif. They include petrography of xenoliths and xenocrysts (zircons) in the Caledonian magmatic rocks, and lithic fragments in the early Cambrian sediments, and geochemistry and Sr and Nd isotopic composition of the liquid lines of descent of the Caledonian magmatic rocks and of Cambrian-Ordovician fine sediments. The postulated Precambrian crystalline basement under the Brabant Massif is partly older than 1.8 Ga and is probably derived from Gondwana and not from the Baltic shield. From these data, a caledonian plate configuration is proposed where southern Britain and Belgium composed a crystalline microplate called "Brabantia".

Because hitherto no recent structural studies were published on the Brabant Massif, it was worthwhile to incorporate a review on the Lower Palaeozoic Massifs in the Ardennes, where the structures and tectonic evolution are well documented. However, the presence of either Caledonian or Variscan or both events was often a controversial issue in the literature. D. Delvaux & D. Laduron combine a review of the relevant structural evidence in the literature with their

own observations on the Caledonian tectonic events in the Lower Palaeozoic Ardenne Massifs, especially in the Rocroi Massif. They discuss the succession and importance of the different phases of Caledonian deformation and of Variscan overprint.

J. Verniers & G. Van Grootel review the literature and own partly unpublished data on the Silurian of the Brabant Massif. The lithostratigraphy of this 2850 m thick turbiditic sequence with intercalated laminated hemipelagites is discussed, together with the presence of fossils and biozonations (mainly graptolite and Chitinozoa), sedimentology and palaeoenvironment. The Silurian tectonic evolution is placed in a longer perspective, with what is known in the Brabant Massif from the Cambrian to Devonian.

New data on the sedimentology, stratigraphy and structure of the Brabant Massif came from the Lessines borehole, 435 m deep and completely cored. Started in the base of the Caledonian sill it reached four sedimentary units separated by a conglomerate, a fault or a facies change. A. Herbosch, M. Vanguestaine, J.M. Degardin, L. Dejonghe, N. Fagel & T. Servais describe the lithostratigraphy, the sedimentology, the biozonation with graptolites, acritarchs and Chitinozoa, and the correlation with units defined in the outcrop areas to the east.

M. Vanguestaine describes in a separate article the systematics on the acritarchs from two levels in the Lessines borehole. In one a lacuna is proven of a large part of the Middle Cambrian, the entire Late Cambrian and possibly part of the Tremadoc. In another level the lateral equivalent of the top of the unfossiliferous "Assise" of Oisquercq is dated close to the Lower and Middle Cambrian. It also proves for the first time the correlation between the "Assise" of Oisquercq in the Brabant Massif and the top of the Devillian units in the Ardenne Massifs.

T. Servais studied the middle Ordovician Rigenée formation in two valleys of the Brabant Massif. He describes its outcrops, maps it in the type locality in the Thyle Valley and dates this fossil poor unit with acritarchs. He is the first to map this formation in another valley, the Orneau, and to prove this correlation with acritarchs. Most elements are brought together now,to formally define in the near future this formation.

In a large section in the Sennette Valley T. Servais describes the presence of some distal turbiditic levels of Caradoc age. Turbidites were until now not described in the Ordovician of the Brabant Massif. In this volume at least two levels with turbidites are now reported: one described by Servais and two in the Lessines borehole, one Tremadoc in age and the other Caradoc, possibly at the same level as in the Sennette Valley (Herbosch et al.).

New data came also from a large number of geotechnical and cored shallow boreholes in the Sambre and Meuse Belt around Ombret. A multidisciplinary approach by L. Hance, P. Steemans, E. Goemaere, Y. Somers, G. Vandenven, M. Vanguestaine & J. Verniers on these boreholes and outcrops in the vicinity, allowed to distinguish areas with typical Sambre and Meuse Belt affinity, in contact with areas bearing a Brabant Massif affinity. Furthermore tectonic units were distinguished with different Caledonian and Variscan burial history. The Sambre and Meuse Belt and the concept of the Variscan front in Belgium will have to be reinterpreted according to these finds.

The Upper Palaeozoic evolution of the eastern border of the Brabant Massif is documented by E. Poty in the Meuse Valley between Liège and Visé. Since late Givetian or Early Frasnian till Namurian times block faulting occurred on five different blocks. It affected their facies and thicknesses and had a changing rate and sense of sub- or emergence of the blocks.

Another methodology, hydrogeology was applied on the Brabant Massif and indicates possibly the present-day stress direction. L. Lebbe, M. Mahauden & W. De Breuck applied their numerical inverse model on pumping tests in four different sites in the Brabant Massif. The results show an anisotropic aquifer with a broadly ENE-WSW direction of maximum transmissivity in three pumping sites (N 61°E, N 64°E, N 86°E). The fourth pumping site gave mathematically two possible solutions.

The excursion guidebook of the two-day post-symposium excursion to the sedimentary and magmatic rocks in the Brabant Massif forms another issue of this volume. Except for some minor changes related to the articles in this volume, it reproduces the guidebook as distributed on the excursion. Since no recent guidebooks are present on the Brabant Massif the editors thought that it could help the geological community to have it published.