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I. REPORT ON I.U.G.S. WORKING GROUP ON THE DEVONIAN-CARBONIFEROUS BOUNDARY MEETING July 16th, 1980, held at Universite de Paris Pierre et Marie Curie, 4 place Jussieu, Paris (5e).

Attending: Voting members: I. CHLUPAC, B. GLENISTER, M. HOUSE, M. LYS, B. MAMET, E. PAPROTH, Chairwoman, C.A. SANDBERG, K. SIMAKOV, W. ZIEGLER and M. STREEL, Secretary.

Apologies for non attendances were received from L.I. KONONOVA, E.A. REITLINGER and G. PLAYFORD.

The meeting originally scheduled at the International Geological Congress was held at the Laboratoire de Geologie dynamique of the Paris University by courtesy of Professor LETOLLE. The items below formed part of an agenda for joint workshop and business meeting of the Subcommission on Devonian Stratigraphy and our working-group.

E. PAPROTH firstly recalled the RECOMMENDATION voted upon by a large majority of the W.G. and which text was later sent to many researchers around the world. She emphasized that it is now important to begin the search for a boundary stratotype best displaying the S. praesulcata to S. sulcata evolutionary lineage, as well as exhibiting adequate representation among other zonally significant groups.

Regional report were then submitted:

CZECHOSL. I. CHLUPAC commented on the newly voted definition, which maintains within the Devonian groups like the Clymenids and also typical faunas of Ostracodes and Trilobites found in the short interval of the Hangenberg Shales. He pointed out that Czechoslovakia has no suitable rock sequence available for a boundary-stratotype.

O.H. WALLISER explained how the Hangenberg beds (Shale, Sandstone and Limestone) are sometimes extremely reduced (or missing) between the Wocklum Limestone and the Black Alum Shale the base of which might be considered as isochronous.

U.S.S.R. K. SIMAKOV presented sections near the Devon./Carbon. boundary selected by a Soviet working group in 4 areas:

The sections are in the Donetz basin, Northern Ural, Southern Ural and the Omolon region. A discussion arises particularly on the reported joint occurrence of Clymenids, S. sulcata, and Quasiendothyra in a single bed in the Northern Urals.

B. MAMET asserted that confirmation of this occurrence would change the picture, no longer allowing the top of kobeitusana zone to be used as a marker of the D/C boundary.

E. PAPROTH asked members to focus their attention to a particular section and urged Soviet colleagues to document the Ural sections by providing a bed by bed collection and possibly sharing material with other members of the W.G.

K. SIMAKOV mentioned that these sections could be visited during the next Geological Congress but that data (full record) could be published for next year. He later on pointed out that the Omolon sections also provide good displays of joint occurrence of Quasiendothyra and S. sulcata.

U.S.A. C.A. SANDBERG referred to his report on the 1979 field trip to the Upper Mississippi Valley.

CANADA. B. MAMET (see report here enclosed) demonstrated that only the western part of the Canadian Cordillera could possibly yield a suitable succession but that the region is poorly accessible because of the climatic conditions.

AUSTRALIA. A short report by G. PLAYFORD was distributed to the attendance. B. MAMET commented on the very thick sequence of the Canning basin which in his opinion is a potential stratotype that is not as inaccessible as Northeastern USSR (Omolon) or Northwestern America (Brooks). A letter was also received from J. ROBERTS saying that there is no section available displaying the transition S. praesulcata/sulcata in Australia.

BRITISH ISLES. M. HOUSE (see report here enclosed) recalled that no international stratotype car be proposed from the British Isles.

BELGIUM-FRANCE. M. LYS referred to a new definition of a Strunian stage published by the Paris Congress.

GERMANY. M. STREEL showed the relations between the spore content of the highest Hangenberg Shales in the Seiler trenches and Oberrödinghausen boreholes and the thick Irish succession (see figs. 1 and 2 of the report mentioned below).

PALYNOLOGICAL CORRELATIONS. M. STREEL presented (see report here enclosed) the common opinion of a group of palynologists regarding D/C boundary level and boundary stratotype. P. VAN VEEN demonstrated the quantitative significance of the disappearance of S. lepidophytus comparing data from Ireland, Germany (Stockum) and USSR (Timan-Petchora).

After some discussion, the attending members accepted to concentrate researches in the Renish Slate Mountain and some specific region of USSR like the Ural.

The Devonian - Carboniferous Boundary in the British Isles

Stratigraphy about the Devonian-Carboniferous boundary in the British Isles has been reviewed by George et al. (1976) and House et al. (1977) where the Wocklumeria/Gattendorfia Stufen boundary, approximating to the base of the sulcata Zone, was

taken as the standard. The Devonian-Carboniferous boundary as originally defined by Sedgwick and Murchison in 1842 at Fremington Pill, North Devon, lies higher than this and has long been abandoned. No international stratotype can be proposed from the British Isles.

England and Wales (V.R.H.)

In South Devon and North Cornwall full marine sequences at Chudleigh (House and Butcher 1973) and around South Petherwin (Selwood 1971) enabled the Wocklumeria/ Gattandorfia Stufen boundary to be located but the sulcata Zone has not been identified. These sequences are not suitable for stratotype designation.

In North Devon the junction of divisions A and B of the Pilton Beds (Goldring 1971) approximate to the boundary and this is confirmed by conodont and spore correlation (Austin et al. 1970) but the correlation is not yet very refined. The sequence is tectonically disturbed but may come to serve as a regional stratotype especially since a wide range of marine invertebrates occurs within it.

The South Wales sequences which cross the boundary are non-marine and some refinement in spore correlation has been achieved (Clayton et al. 1978) but marine intercalations in the Skrinkle Sandstone now suggest Lower Carboniferous rather than late Devonian date (Bassett and Jenkins 1977).

Ramsbottom and Mitchell (1980) have argued that the Courceyan is the equivalent of the Tournaisian and should be abandoned but it seems preferable to await the international definition of these divisions, the base of which should be defined to correspond with the proposed Devonian/Carboniferous boundary.

The Devonian-Carboniferous Boundary in Ireland (G.D.S.)

George et al. (1976) proposed regional stages as a framework for study of Dinantian rocks in Britain and Ireland. The base of the earliest (Courceyan) stage was defined in a section on the west side of the Old Head of Kinsale, County Cork, Ireland, at the base of the Castle Slate Member of the Kinsale Formation, an horizon which coincides there with the boundary between the Spelaeotriletes lepidophytus - Verrucosisporites nitidus (LN) Subzone and the Vallatisporites varrucosus - Retusotriletes incohatus (VI) Subzone of the Verrucosisporites nitidus - Vallatisporites verrucosus (NV) miospore Zone (Clayton et al. 1974). The base of the Courceyan, recognised by identification of the LN/VI subzonal boundary, has been located in numerous sections in County Cork (see for instance, Clayton and Higgs, 1979). Clayton et al. (1974) have argued that the LN/VI subzonal boundary is the best approximation in Britain and Ireland to the base of the Carboniferous (sensu Heerlen 1935), but it must be stressed that precise correlations will not be possible until the ranges of critical miospore taxa are established in Germany.

Apart from miospores, both micro- and macrofossils occur only sporadically in the enormously thick marine clastic successions of latest Devonian and earlier Carboniferous age in south-west Ireland. The pre-Courceyan Old Head Sandstone and equivalent formations have yielded rare brachiopod faunas (see George et al. p. 71). The earliest Courceyan Castle Slate Member of the Kinsale Formation contains conodonts discussed by Clayton et al. (1978), and as yet unidentified goniatites and ostracodes.

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DEVONIAN-CARBONIFEROUS BOUNDARY SEQUENCES IN CANADA: A SUMMARY

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Three regions of Devonian-Carboniferous successions can be distinguished in Canada:

1. The Fundy epieugeosyncline. The northern part of the Appalachian Orogen was intensively folded during the Devonian Acadian Orogeny. Post-orogenic molasses developed in Late Devonian-Tournaisien time and are mostly represented by the non-marine Horton Group. A "Hymenozonotriletes lepidophytus-H. pussilites" flora (zone C of Barss) has been recorded from the Cape George-Antigonish region (McInnes Brook Formation) by Hacquebard (1972). The overlying, discordant Touriaisian Fisset Brook Formation yield the "Hymenozonotriletes explanatus zone D" of Barss and has been radiometrically dated on basaltic volcanic flows.

There is no known marine fauna present and the basin therefore does not seem a suitable prospect for the solution of the Devonian/Carboniferous problem.

2. The Sverdrup Basin. Sediments in the Axel Heiberg and Ellesmere Islands were also intensively folded in Late Devonian time (see Thorsteinsson, 1974 and Nassichuk, 1975 for recent summary of the historical geology of the region). Folding of the Franklinian Geosyncline was accompanied by metamorphism and injection of grano-diorites and quartzic diorites.

The oldest known Carboniferous rocks form the Visean Emma Fiord Formation, a succession of non-marine deltaic arenites with associated coal beds. The formation has been dated by spores. There is no known marine Tournaisian sediments in the Arctic.

3. The Cordillerans and the Williston Basin. Progressive Tournaisian encroachment of a carbonate platform of the shelf is observed in the Williston Basin. Strati-graphic relations, correlations and paleogeography of the Bakken Formation in the

subsurface of Manitoba, Saskatchewan and Alberta are described in Macauley et al. (1964). The Bakken, very thin and condensed, has thin microconglomerates with reworked phosphatic pebbles, suggesting non-depositional sequences. As the succession is known only through scattered boreholes, with few preserved cores, the Williston offers little prospect for further research.

In the non-metamorphosed part of the Cordillerans, the Rocky Mountains, conodonts and spores have been recovered from the Bakken correlative unit, the Exshaw Formation (Macqueen and Sandberg, 1970). The unit straddles the Devonian-Carboniferous contact. Siphodonella sulcata is recorded by Sandberg, but there is apparently no S. praesulcata. A controversial and rare Imitoceras? goniatite fauna, is to be referred to the Carboniferous. Hymenozonotriletes lepidophytus is also known from the unit. Otherwise, the Exshaw megafauna is extremely poor, the foraminifers are absent and the succession does not seem a possible candidate for a continuous Devonian-Carboniferous sequence.

Further to the North, Middle Tournaisian assemblages are known in the Clausen and in the Besa River Formations of the Northwest Territories (Jackfish River Region) and of Northeastern British Columbia (Peace River-Muskwa River) (Mamet and Bamber, 1979). No strata straddling the Devonian-Carboniferous conodont boundary have been demonstrated but further work is in progress.

West of the "Trench", the internal domain of the Cordillerans has been metamorphosed by Mesozoic orogenies. However, scattered Tournaisian outcrops have been discovered along the Pacific coast; none straddle the presumed Devonian-Carboniferous boundary. These Tournaisian fauna are of particular paleogeographic importance, as they have obvious Tethyan affinities. No complete Quasiendothyrid succession has been encountered. Yet, Quasiendothyra are abundant in the central part of the Brooks Range in Alaska and are very similar to the foraminiferal assemblages described by Yuferev in Simakov (1979) from the Omolon Massif.

In conclusion, for paleogeographic and paleotectonic reasons, only the western part of the Canadian Cordillera could possibly yield the suitable bio- and lithostratigraphic succession requested by the Commission of Stratigraphy. As the region is poorly accessible, the prospect of finding such a rock body, appears to be quite remote.

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PALYNOLOGIST'S COMMENT REGARDING THE DEFINITION OF THE DEVONIAN/CARBONIFEROUS BOUNDARY

This report collates the views of ten palynologists who had a meeting on the subject on Friday 4th July 1980 during the 5th International Palynological conference at Cambridge (UK). All have published papers using spores to delineate the Devonian/Carboniferous boundary in many regions of the world. Their names are listed below: CLAYTON and HIGGS (Ireland), LOBOZIAK (France), McGREGOR (Canada), PLAYFORD (Australia), RICHARDSON (UK), STREEL (Belgium), TURNAU (Poland), VAN DER ZWAN and VAN VEEN (The Netherlands).

1. We recommend that the level of the Wocklumeria/Gattendorfia transitional beds continue to be accepted as the Devonian/Carboniferous boundary.

We recall that a similar statement was published by all palynologists (most from USSR) during the 8th Carboniferous Congress held at Moscow in 1975.

2. We want to emphasize the real time significance of these transitional beds which are not just a few metres of shales between rich fossiliferous limestones in the historic type region but are developed as more than 800 metres thick nearshore and continental sediments in Ireland.

3. We do not wish to claim for a boundary-stratotype to be defined in a nearshore facies but we would reject as well a too marginal distal facies devoid of spores or a section where there is evidence of slumping or other disturbing sedimentological processes. We believe that one cannot ignore such a fossil group which has the potential to accomodate any limits proposed in this interval and also enables us to correlate between continental and marine sediments (see fig. 1 enclosed).

4. Indeed, just as well as the five conodont zones ranging from sulcata to crenulata do correspond to a single spore zone (VI) in the lower part of the Carboniferous, 3 spore (sub)zones ranging from LL to LN correspond to the upper part of the praesulcata zone in the uppermost Devonian (see fig. 2). (We do not want to emphasize here the first occurrence of the lepidophytus spore zone and its lowermost subdivisions which allow accurate correlations with Foram. stratigraphy in the costatus-middle praesulcata range.)

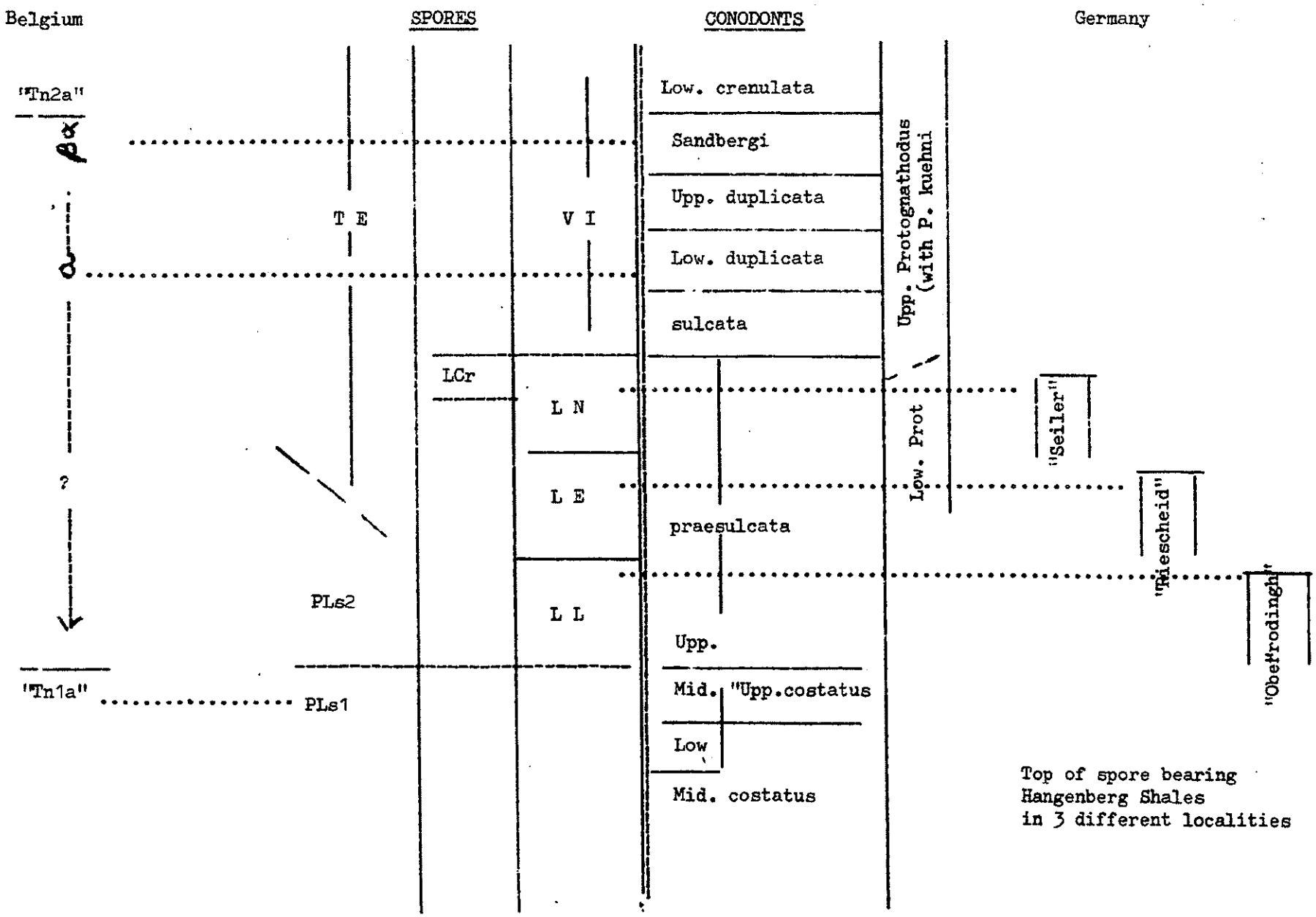
5. Our most secure and useful limit is certainly the base of Hymenozonotriletes explanatus (limit LL/LE subzones) which occurs both in continental (Hoek Head) and nearshore marine beds (Old Head of Kinsale) in southern Ireland but can also be traced in some slope sediments (with mass transport?) in Germany (Riescheid). The base of H. explanatus which is not a dramatic event is also known in Australia, North America and in USSR (most detailed information from the Timan-Petchora).

6. The LN/VI limit which corresponds to the extinction of S. lepidophytus seems to match more or less the base of the sulcata level as high LN spore assemblages are encountered immediately below the Stockum Limestone in Germany (Siler). However delay between first deposition and possible mass transport cannot be ruled out in such an environment which makes the accurate correlation hazardous owing to the fact that the LN/VI limit is primarily based on extinction criteria.

That this level represents a world wide change is obvious (see the quantitative work made by Van Veen in Ireland and comparison with Timan-Petchora in USSR), but we are not yet prepared to specify the accurate first incoming of zone VI. More work has to be done to support the disappearance of S. lepidophytus at this level.

7. As a final comment, we welcome that definitions are required in more precise terms. In the same way, we would not consider the change of definition to be more accurate if not typified in a boundary-stratotype carrying both the new zone characteristic and the ancestor in a continuous lithological sequence.

M. STREEL
CIMP W-G on the D./C. boundary, convenor.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