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CORRELATION OF THE BRENT FORMATION
IN WELLS 33/9-3, 33/9-9, 33/9-A18
AND 33/9-A37

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- 7 NOV. 1983

REGISTRERT
OLJEFORSTÅELSE

31.8.1983



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INTRODUCTION

This report presents a palynological correlation of the Brent Formation in Wells 33/9-3, 33/9-9, 33/9-A18 and 33/9-A37. Detailed information from Well 33/9-3 were available from previous studies carried out under NPD-project "Paleontologiske og sedimentologiske undersøkelser i Juralagrekken i nordlige Nordsjø", lead by J.Nagy, University of Oslo, and from the thesis "Palynologiske undersøkelser av Brent-gruppen i brønn 33/9-3 på Statfjordfeltet" by Ingar Throndsen, University of Oslo.

Samples covering the Dunlin - Brent transition in Well 33/9-9 previously studied under the NPD-project were also included in the present study.

Fifty-two conventional and sidewall cores and ditch cuttings samples were examined for this project.

Signe Line Røe, NPD, initiated and defined the project and assisted during sampling. Her cooperation is acknowledged.

Well 33/9-3 (8000 - 8600 feet) Enclosures 1, 2

Palynological information from this well were obtained from previous reports and from the thesis by Ingar Thronsen, University of Oslo. A range chart and a quantitative distribution chart from this thesis are enclosed with this report (Enclosures 1 and 2.)

Two additional samples from the uppermost part of the Brent Formation at 7945 feet and 8802 feet produced only poor assemblages.

The interval has been subdivided into 10 units on the basis of qualitative and quantitative palynological information (Enclosure 3).

Unit 1 covers the uppermost part of the Drake Member (8600 - 8557 feet) and is characterized by occurrence of marine elements like Comparodinium punctatum, Micrhystridium spp., Sentusidinium sp., Parvocysta spp., Nannoceratopsis gracilis, Mancodinium semitabulatum and Kalyptea halosa. This assemblage in association with Callialasporites turbatus, C.dampieri, C.trilobatus and C.microvelatus define a late Toarcian age for this unit.

Unit 2 covers a thin sandstone interval (8556 - 8554 feet) and is characterized by an abrupt increase in terrestrial palynomorphs, especially Deltoidospora minor, and a reduction in marine elements. C.punctatum and Parvocysta spp. do not range into this unit due to change in depositional environment.

Unit 3 is defined on the basis of a distinct maximum in Nannoceratopsis gracilis at 8554 feet, a reduction takes place upwards, and above 8545 feet it is only sporadically present. This development marks the introduction of Unit 4 (8543 - 8516 feet) characterized by a relative increase in

terrestrial palynomorphs and dominance of Perinopollenites elatoides.

Unit 5 (8500 - 8280 feet) is poorly covered. Low palynomorph productivity is characteristic for this interval. Where palynomorphs are present assemblages are dominated by locally derived species such as D.minor, Osmundacidites/Baculatisporites spp., P.elatoides and C.classoides.

Unit 6 is defined on the basis of one assemblage at 8264 feet which is characterized by a distinct maximum in Densoisporites crassus associated with abundant Cerebropollenites mesozoicus and D.minor. A slight marine influence is noted at this level by the presence of rare N.gracilis. Foveosporites canalis and Leptolepidites paverus appear at the base of this unit.

Unit 7 (8241 - 8192 feet) is characterized by appearance of Leptolepidites equatibossus and L.rotundus and a maximum in Araucariacites australis. Rare N.gracilis is again present in the upper part of this unit indicating slight marine influence.

Marine influence reaches a maximum within Unit 8, resulting in a distinct maximum in N.gracilis. The appearance of Neoraistrickia gristhorpensis and Crybelosporites vectenensis is noted within Unit 8. A distinct maximum of D.minor is also observed within this unit, varying inversely with P.elatoides.

Unit 9 is defined on the basis of a distinct maximum in Klukisporites (=Ischyosporites) variegatus around the coal seam at 8100 feet. It is associated with abundant D.minor.

Unit 10 is characterized by a distinct maximum of Lycopodiumsporites spp. in the shale just below 8050 feet. It is accompanied by maximum in P.elatoides and a decrease in D.minor. An increase in Classopollis classoides is noted as Lycopodiumsporites spp. decreases just above 8050 feet.

The samples examined from the sandstones above 8030 feet all show low palynomorph productivity, and the assemblages are not stratigraphically significant.

Supposed reworked specimens of Ricciisporites tuberculatus of Late Triassic age have been recorded from Units 10, 3 and 1. It is clearly best represented within Unit 1.

Well 33/9-9 (2420 - 2516m) Enclosure 3

Thirty-one conventional core samples have been studied from this well.

Assemblages examined between 2516.4m and 2503.8m contained Comparodinium punctatum var. magnum, C. punctatum, Parvocysta spp., Phallocysta eumekes, Facetodinium faustum and N. gracilis. Callilalaspores dampieri was recorded down to 2512.2m. These assemblages show the presence of Unit 1 within this interval.

A relative maximum in N. gracilis is seen at 2503.3m. It is associated with common Botryococcus. The dinocyst assemblage recorded below is absent. This horizon belongs to Unit 3 as defined in Well 33/9-3. The thin sandstone bed between 2503.8m and 2503.3m was not examined, but is obviously an equivalent to the Unit 2 interval in Well 33/9-3.

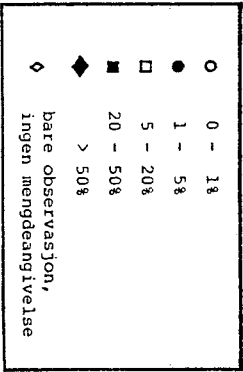
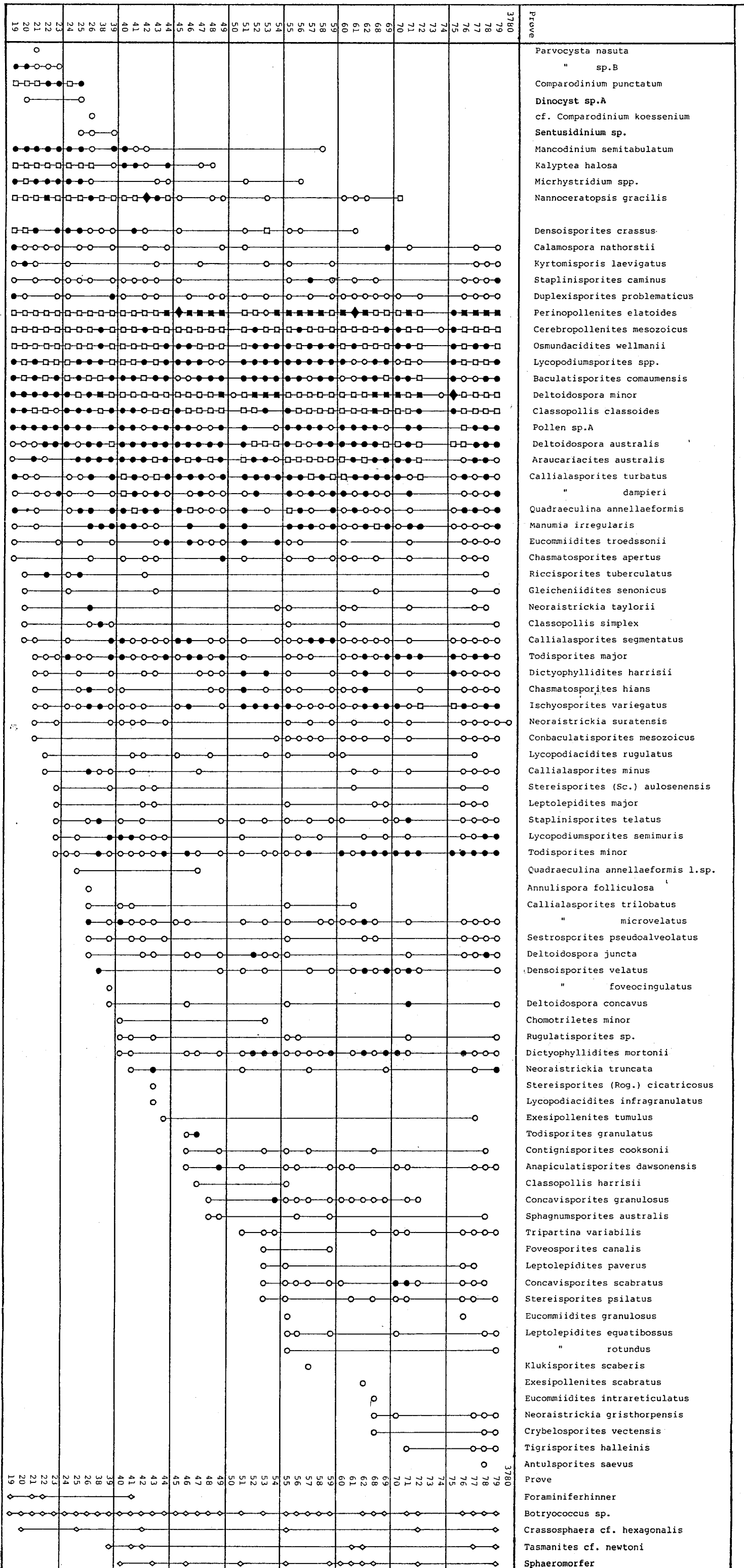
The development seen in the assemblages from 2501.9m to 2497.3m caused by a progradation closely corresponds to that seen from Unit 4 to 5 in Well 33/9-3. However, sample density does not allow a more precise location of the boundaries between these units here.

Samples examined up through the sandstone interval to 2459.3m were all barren of palynomorphs. This may be regarded as corresponding to Unit 5 in Well 33/9-3.

No assemblage corresponding to that defining Unit 6 has been observed in this well.

Between 2455.3m and 2442.8m assemblages corresponding to those recorded from Unit 7 appear. Leptolepidites equatibossus

RANGE CHART



Vertikal opptreden av de enkelte artene gjennom det undersøkte intervallet i brønn 33/9-3.

and L.paverus appear at 2455.3m. At 2450.3m a maximum in A.australis is observed together with Deltoidospora spp., P.elatoides and C.classoides. A change in composition is seen at 2448.8m where P.elatoides and C.classoides reach a second maximum. This compares with the development observed within Unit 7 in Well 33/9-3.

A slight marine influence is suggested by the presence of rare Micrhystridium spp.

Unit 8 defined by a maximum in N.gracilis has not been identified in this well.

The Klukisporites (= Ischyosporites) variegatus maximum defining Unit 9 has not been recorded from this well either. A possible presence of beds equivalent to the upper part of Unit 9 between 2442.8m and 2437.2m can, however, not be excluded.

The presence of Unit 10 is suggested between 2436.5m and 2433.8m with a maximum in P.elatoides at 2436.5m and presence of Lycopodiumsporites cf. rosewoddensis, L.austroclavatidites, L.semimuris and other unspecified Lycopodiumsporites spp. at 2433.8m. This is associated with a characteristic decrease in Deltoidospora spp.

Samples examined at 2431.1m and 2420.3m did not produce stratigraphically significant assemblages.

Well 33/9-A18 (2869 - 2940m) Enclosure 4

Eleven ditch cuttings samples were examined from this well. Poorer sample quality and lower productivity make comparison with the other two wells difficult. However, the information available shows that the assemblage at 2940m and 2934m belong to Unit 1 with the presence of N.gracilis and Micrhystridium sp. and questionable specimens of Parvocysta bullula.

The assemblages from the shale interval 2869 - 2877m probably belong to Unit 7.

Assemblages obtained from the shale interval 2900 - 2905m are clearly different from those at 2869 - 2877m mainly based on negative evidence by the absence of Botryococcus and a number of local spore and pollen species. This reflects a distinct difference in sedimentary environment between these shale intercalations. The upper interval was deposited in a top delta environment with accumulation of locally derived plant debris protected from fluvial influence, while the lower was influenced by fluvial processes.

Well 33/9-A37 (3103 - 3138.5m) Enclosure 5

Eight sidewall cores were examined from this well. No lithological or log information was available from this well.

The assemblage recorded from the lowermost sample at 3138.5m contains C.punctatum, M.semitabulatum, Parvocysta nasuta and N.gracilis. This assemblage characterizes Unit 1 as defined from Well 33/9-3. The absence of Callialasporites sp. and several other spore and pollen species makes it possible that a slightly deeper part of the Drake Member is present here.

The assemblage at 3136m and 3133.5m is referred to Unit 5 by the absence of marine elements and maximum in C.classoides.

A relative maximum in Klukisporites (=Ischyosporites) variegatus at 3122.6m seems to justify a reference to Unit 9 at this level. The assemblage recorded at 3126m may possibly be referred to Unit 7, but it is not typically developed here. Assemblages characterizing Units 6 and 8 were not recorded.

A relative maximum in Lycopodiumsporites spp. at 3108.5m in association with abundant C.classoides represent a Unit 10 assemblage.

The assemblage at 3103m is characterized by common species of the dinocyst complex described by DeVains as Kyste spp.B and C. This assemblage represents a marine transgression of latest Bajocian to earliest Bathonian age. It is probably separated from the Ness Member equivalent below by a hiatus.

The palynomorph and kerogen assemblages examined from Well 33/9-A37 are all dominated by terrestrially derived debris, mainly of wood origin. Spores and pollen are common to abundant. The samples at 3103m and 3138.5m show a marine influence and were probably formed in marginal marine environments. Composition of spore and pollen assemblages indicates that top delta conditions were established at 3108.5m and 3122.6m and probably also at 3136m. A slight marine influence is noted at 3113.5m by the appearance of N.gracilis.

DISCUSSION

A correlation of the four wells based on the interpretations given above is presented in Enclosure 6.

From the stratigraphical sequences and palynomorph assemblage composition it is clearly seen that Well 33/9-3 occupied the most distal position and 33/9-A18 the most proximal position during the deposition of the sediments studied.

Preservation and diversity of the marine assemblages recorded from the uppermost part of the Drake Member show that this was the case already at this level. The transition from Unit 1 to Unit 5 is most completely developed in Well 33/9-3, the different stages are also identified in 33/9-9, while in 33/9-A18 it seems to be abrupt, possibly erosional.

The results from Well 33/9-A37 is surprising since the Drake Member is identified only about 20m below Unit 9 regarded as the middle part of the Ness Member. If the assemblages recorded are "in situ" this means that Rannoch - Etive Members are condensed or absent from this well.

Marine influence is greater in Well 33/9-3 than in Well 33/9-9 above Unit 5. In Well 33/9-A18 marine influence was not observed above Unit 1, and in Well 33/9-A37 only a weak marine influence is noted at 3113.5m.