

Palynological investigation of the well O18-1

Introduction

At the request of Placid International Oil, Ltd., the interval between 3750 and 5170 ft of the well O18-1 was sampled and palynologically investigated. The purpose of this study is to come to an age-determination.

Results

Based on the miospore assemblages which have been recognised in the examined samples the following age is proposed:

- from 3750 till 4790 ft : **Late Westphalian A**
- from 4790 till 5170 ft : **Early Westphalian A**

Samples

The following samples have been processed in the laboratory, using standard preparation techniques. Those samples marked with an asterisk (*) were selected for palynological examination (depth in ft):

Cutting-samples:

3750(*), 3770(*), 3780, 3840, 3870, 3910(*), 3920, 3970, 4040(*), 4080(*), 4210(*), 4280(*), 4330(*), 4510(*), 4530(*), 4560(*), 4790(*), 4930(*), 5120(*) and 5170(*)

Core-samples:

3876, 3876-coal (*), 3890(*), 3899(*), 3909.1-coal (*), 3916.5(*), 3925(*), 3928.3, 3933.9, 3937, 3944(*), 3946(*), 3954.5, 3962.4, 3992(*), 3993.4 and 3995.

Discussion

The interval between 3750 ft and 4790 ft is characterised by the regular occurrence of the miospore species *Radiizonates aligerens* together with the more scattered occurrence of *Schulzospora rara*, indicating a Late Westphalian A age. In the lowermost cutting-samples of this interval *R.aligerens* might be present due to caving, but this is hard to verify by the absence of core-samples at this depth. So, most probably the boundary Early/Late Westphalian A is situated between 4790 and 4930 ft or a little higher in the sequence.

Although the boundary Namurian/Westphalian A is not always easy to find with palynological tools, in well O18-1 it is concluded that Namurian strata are not penetrated, because of the thin interval older than Late Westphalian A (4930-5170 = 240 ft) and because of the presence of *Cingulizonates loricatus* at 4930 and 5120 ft.

Very interesting is the occurrence of the miospore species *Retispora lepidophyta* (Upper Famennian) in the sample at 4790 ft, indicating that reworked material is present at this depth.

Sample contents

3750 ft - Cutting

<i>Cristatisporites connexus</i>	<i>Crassispora kosankei</i>
<i>Vestispora pseudoreticulata</i>	<i>Radiizonates aligerens</i>
<i>Laevigatosporites minor</i>	<i>Schulzospora rara</i>
<i>Reticulatisporites polygonalis</i>	<i>Raistrickia fulva</i>
<i>Densosporites sphaerotriangularis</i>	
<i>Schopfipollenites ellipsoides</i> var. <i>corporeus</i>	
Indet. Monosaccate pollen	
<i>Calamospora</i> spp.	<i>Lycospora</i> spp.
<i>Punctatisporites</i> spp.	<i>Knoxisporites</i> spp.
<i>Apiculatisporis</i> spp.	<i>Cyclogranisporites</i> spp.
<i>Dictyotriletes</i> sp.	<i>Potonieisporites</i> sp.
<i>Triquitrites</i> sp.	<i>Florinites</i> spp.

3770 ft - Cutting

<i>Crassispora kosankei</i>	<i>Verrucosisporites sifati</i>
<i>Laevigatosporites minor</i>	<i>Cingulizonates loricatus</i>
<i>Raistrickia fulva</i>	<i>Savitrissporites nux</i>
<i>Endosporites zonalis</i>	<i>Alatisporites pustulatus</i>
<i>Cirratriradites saturni</i>	<i>Radiizonates aligerens</i>
<i>Grumosporites varioreticulatus</i>	
<i>Densosporites sphaerotriangularis</i>	
<i>Reinschospora</i> sp.	<i>Lycospora</i> spp.
<i>Punctatisporites</i> spp.	<i>Florinites</i> spp.
<i>Apiculatisporis</i> spp.	<i>Potonieisporites</i> sp.
<i>Calamospora</i> spp.	<i>Lophotriletes</i> spp.

3876 ft - Core (coal)
Barren

3890 ft - Core

<i>Crassispora kosankei</i>	<i>Cirratriradites saturni</i>
<i>Punctatisporites sinuatus</i>	<i>Radiizonates aligerens</i>
<i>Cristatisporites connexus</i>	<i>Cingulizonates loricatus</i>
<i>Savitrissporites nux</i>	<i>Laevigatosporites minor</i>
<i>Reticulatisporites reticulatus</i>	
<i>Densosporites sphaerotriangularis</i>	
<i>Convolutispora</i> sp.	<i>Verrucosisporites</i> spp.
<i>Calamospora</i> spp.	<i>Florinites</i> spp.

3899 ft - Core

<i>Crassispora kosankei</i>	<i>Radiizonates aligerens</i>
<i>Laevigatosporites minor</i>	<i>Densosporites anulatus</i>
<i>Densosporites triangularis</i>	
<i>Densosporites sphaerotriangularis</i>	
<i>Calamospora</i> spp.	<i>Lycospora</i> spp.
<i>Florinites</i> spp.	<i>Apiculatisporis</i> spp.

3909.1 ft - Core (coal)
Barren

3910 ft - Cutting

<i>Crassispora kosankei</i>	<i>Radiizonates aligerens</i>
<i>Raistrickia fulva</i>	<i>Raistrickia saetosa</i>
<i>Laevigatosporites minor</i>	<i>Cirratriradites saturni</i>
<i>Apiculatisporis aculeatus</i>	<i>Apiculatisporis abditus</i>
<i>Acanthotriletes triquetrus</i>	<i>Ahrensisporites guerickei</i>
<i>Cyclogranisporites aureus</i>	<i>Schulzospora rara</i>
<i>Cyclogranisporites multigranus</i>	
<i>Densosporites sphaerotriangularis</i>	
<i>Grumosisporites varioreticulatus</i>	
<i>Apiculatasporites spinulistratus</i>	
<i>Dictyotriletes</i> sp.	<i>Savitrissporites</i> sp.
<i>Potonieisporites</i> sp.	<i>Leiotriletes</i> spp.
<i>Lophotriletes</i> spp.	<i>Calamospora</i> spp.
<i>Lycospora</i> spp.	<i>Verrucosisporites</i> spp.
Indet. Monosaccate pollen	

3916.5 ft - Core

<i>Crassispora kosankei</i>	<i>Savitrisporites nux</i>
<i>Laevigatosporites minor</i>	<i>Radiizonates aligerens</i>
<i>Raistrickia fulva</i>	<i>Raistrickia saetosa</i>
<i>Densosporites sphaerotriangularis</i>	
<i>Densosporites anulatus</i>	
<i>Schopfipollenites ellipsoides</i>	
<i>Reticulatisporites reticulatus</i>	
<i>Calamospora</i> spp.	<i>Apiculatisporis</i> spp.
<i>Cyclogranisporites</i> spp.	<i>Lycospora</i> spp.
<i>Potonieisporites</i> sp.	<i>Punctatisporites</i> spp.
<i>Pteroretis</i> sp.	<i>Verrucosisporites</i> spp.
Indet. Monosaccate pollen	

3925 ft - Core

<i>Radiizonates aligerens</i>	<i>Laevigatosporites minor</i>
<i>Radiizonates striatus</i>	<i>Crassispora kosankei</i>
<i>Savitrisporites nux</i>	<i>Schulzospora rara</i>
<i>Cingulizonates loricatus</i>	<i>Raistrickia saetosa</i>
<i>Punctatisporites sinuatus</i>	<i>Florinites</i> spp.
<i>Densosporites triangularis</i>	
<i>Densosporites sphaerotriangularis</i>	
<i>Reticulatisporites polygonalis</i>	
<i>Knoxisporites</i> sp.	<i>Lycospora</i> spp.
<i>Apiculatisporis</i> spp.	<i>Calamospora</i> spp.
Indet. Monosaccate pollen	

3944 ft - Core

<i>Crassispora kosankei</i>	<i>Radiizonates aligerens</i>
<i>Cyclogranisporites aureus</i>	<i>Laevigatosporites minor</i>
<i>Cingulizonates loricatus</i>	<i>Endosporites globiformis</i>
<i>Verrucosisporites verrucosus</i>	<i>Pteroretis</i> sp.
<i>Densosporites sphaerotriangularis</i>	
<i>Reticulatisporites reticulatus</i>	<i>Lycospora</i> spp.
<i>Grumosisorites varioreticulatus</i>	
<i>Convolutispora</i> sp.	<i>Florinites</i> spp.
<i>Apiculatisporis</i> spp.	<i>Calamospora</i> spp.
Indet. Monosaccate pollen	

3946 ft - Core

<i>Crassispora kosankei</i>	<i>Radiizonates aligerens</i>
<i>Ahrensiporites guerickei</i>	<i>Savitrisporites nux</i>
<i>Pustulatisporites pustulatus</i>	<i>Endosporites zonalis</i>
<i>Densosporites sphaerotriangularis</i>	
<i>Densosporites triangularis</i>	

Punctatisporites spp.
Calamospora spp.
Florinites spp.
cf. *Potonieisporites* sp.
Indet. Monosaccate pollen

Cristatisporites sp.
Raistrickia spp.
Knoxisporites sp.

3992 ft - Core

Endosporites globiformis
Crassispora kosankei
Radiizonates aligerens
Cingulizonates loricatus
Cristatisporites connexus
Cyclogranisporites aureus
Apiculatisporites spinulistratus
Densosporites sphaerotriangularis
Grumosisporites varioreticulatus
Reticulatisporites reticulatus
Verrucosisporites spp.
Apiculatisporis spp.
Raistrickia spp.
Indet. Monosaccate pollen

Endosporites zonalis
Laevigatosporites minor
Radiizonates faunus
Savitrissporites nux
Alatisporites pustulatus
Lycospora spp.

Convolutispora spp.
Calamospora spp.
Florinites spp.

4040 ft - Cutting

Cirratriradites saturni
Radiizonates aligerens
Crassispora kosankei
Converrucosisporites armatus
Densosporites triangularis
Densosporites sphaerotriangularis
Grumosisporites varioreticulatus
Granulatisporites microgranifer
Reticulatisporites reticulatus
Convolutispora sp.
Cyclogranisporites spp.
Calamospora spp.
Raistrickia spp.
Indet. Monosaccate pollen
Fragments of megaspores

Savitrissporites nux
Schulzospora rara
Laevigatosporites minor

Knoxisporites sp.
Apiculatisporis spp.
Lycospora spp.
Pustulatisporites sp.

4080 ft - Cutting

Vestispora cf. *pseudoreticulata*
Murospora intorta
Cirratriradites saturni
Radiizonates aligerens
Crassispora kosankei

Laevigatosporites minor
Schulzospora rara
Savitrissporites nux
Lophotriletes triquetrus

<i>Microreticulatisporites</i> cf. <i>nobilis</i>	
<i>Grumosisporites varioreticulatus</i>	
<i>Calamospora</i> spp.	<i>Apiculatisporis</i> spp.
<i>Raistrickia</i> spp.	<i>Convolutispora</i> sp.
<i>Florinites</i> spp.	<i>Lycospora</i> spp.
<i>Verrucosisporites</i> spp.	<i>Punctatisporites</i> spp.
Indet. Monosaccate pollen	Megaspore fragments

4210 ft - Cutting

<i>Raistrickia fulva</i>	<i>Crassispora kosankei</i>
<i>Radiizonates aligerens</i>	<i>Laevigatosporites minor</i>
<i>Verrucosisporites verrucosus</i>	<i>Endosporites zonalis</i>
<i>Savitrissporites nux</i>	<i>Cristatisporites</i> sp.
<i>Schopfiipollenites ellipsoides</i> var. <i>corporeus</i>	
<i>Densosporites sphaerotriangularis</i>	
<i>Densosporites triangularis</i>	
<i>Grumosisporites varioreticulatus</i>	
<i>Calamospora</i> spp.	<i>Lycospora</i> spp.
<i>Punctatisporites</i> spp.	<i>Pustulatisporites</i> sp.
<i>Convolutispora</i> sp.	<i>Florinites</i> spp.
<i>Cingulizonates</i> sp.	

4280 ft - Cutting

<i>Dictyotriletes bireticulatus</i>	<i>Savitrissporites nux</i>
<i>Crassispora kosankei</i>	<i>Raistrickia saetosa</i>
<i>Cingulizonates loricatus</i>	<i>Radiizonates aligerens</i>
<i>Laevigatosporites minor</i>	
<i>Grumosisporites varioreticulatus</i>	
<i>Apiculatasporites spinulistratus</i>	
<i>Densosporites</i> spp.	<i>Florinites</i> spp.
<i>Apiculatisporis</i> spp.	<i>Lycospora</i> spp.

4330 ft - Cutting

<i>Cingulizonates loricatus</i>	<i>Murospora intorta</i>
<i>Crassispora kosankei</i>	<i>Raistrickia fulva</i>
<i>Laevigatosporites minor</i>	<i>Radiizonates aligerens</i>
<i>Acanthotriletes triquetrus</i>	<i>Cirratiradites saturni</i>
<i>Ahrensissporites guerickei</i>	<i>Savitrissporites nux</i>
<i>Grumosisporites varioreticulatus</i>	
cf. <i>Vallatisporites</i> sp.	<i>Florinites</i> spp.
<i>Cristatisporites</i> sp.	<i>Densosporites</i> spp.
<i>Punctatisporites</i> spp.	<i>Verrucosisporites</i> spp.
<i>Calamospora</i> spp.	<i>Lycospora</i> spp.
<i>Apiculatisporis</i> spp.	
Megaspore fragments	

4510 ft - Cutting

<i>Cirratriradites saturni</i>	<i>Savitrisporites nux</i>
<i>Crassispora kosankei</i>	<i>Laevigatosporites minor</i>
<i>Ahrensisporites guerickei</i>	<i>Radiizonates faunus</i>
<i>Dictyotriletes muricatus</i>	
<i>Cristatisporites indignabundus</i>	
<i>Densosporites sphaerotriangularis</i>	
<i>Grumosisporites varioreticulatus</i>	
<i>Schopfiipollenites ellipsoides</i>	
<i>Verrucosisporites</i> spp.	<i>Knoxisporites</i> spp.
<i>Raistrickia</i> spp.	<i>Lycospora</i> spp.
<i>Apiculatisporis</i> spp.	<i>Punctatisporites</i> spp.
<i>Florinites</i> spp.	Indet. Monosaccate pollen

4530 ft - Cutting

<i>Reinschospira speciosa</i>	<i>Crassispora kosankei</i>
<i>Radiizonates aligerens</i>	<i>Savitrisporites nux</i>
<i>Alatisporites pustulatus</i>	
<i>Grumosisporites varioreticulatus</i>	
<i>Densosporites sphaerotriangularis</i>	
<i>Reticulatisporites polygonalis</i>	
<i>Cristatisporites indignabundus</i>	
<i>Knoxisporites</i> sp.	<i>Lycospora</i> spp.
<i>Calamospora</i> spp.	<i>Florinites</i> spp.
<i>Raistrickia</i> spp.	<i>Convolutispora</i> spp.
<i>Apiculatisporis</i> spp.	Indet. Monosaccate pollen

4560 ft - Cutting

<i>Raistrickia saetosa</i>	<i>Raistrickia fulva</i>
<i>Crassispora kosankei</i>	<i>Radiizonates aligerens</i>
<i>Endosporites zonalis</i>	<i>Cingulizonates loricatus</i>
<i>Reinschospira speciosa</i>	<i>Savitrisporites nux</i>
<i>Punctatisporites sinuatus</i>	
<i>Schopfiipollenites ellipsoides</i> var. <i>corporeus</i>	
<i>Apiculatasporites spinulistratus</i>	
<i>Densosporites sphaerotriangularis</i>	
<i>Calamospora</i> spp.	<i>Lycospora</i> spp.
<i>Leiotriletes</i> sp.	<i>Apiculatisporis</i> spp.
<i>Florinites</i> spp.	<i>Verrucosisporites</i> sp.

4790 ft - Cutting

<i>Savitrisporites nux</i>	<i>Cingulizonates loricatus</i>
<i>Radiizonates aligerens</i>	<i>Crassispora kosankei</i>
<i>Reticulatisporites polygonalis</i>	<i>Raistrickia saetosa</i>
<i>Densosporites sphaerotriangularis</i>	

Retispora lepidophyta (Reworked Upper Famennian !!)
Florinites spp. *Knoxisporites* spp.
Calamospora spp. *Convolutispora* spp.
Lycospora spp. *Leiotriletes* spp.
 Indet. Monosaccate pollen

4930 ft - Cutting

<i>Savitrissporites nux</i>	<i>Savitrissporites concavus</i>
<i>Crassispora kosankei</i>	<i>Cingulizonates loricatus</i>
<i>Reticulatisporites reticulatus</i>	cf. <i>Pteroretis</i> sp.
<i>Verrucosisporites</i> sp.	<i>Convolutispora</i> sp.
<i>Apiculatisporis</i> spp.	<i>Punctatisporites</i> sp.
<i>Florinites</i> spp.	<i>Knoxisporites</i> spp.
<i>Calamospora</i> spp.	Indet. Monosaccate pollen

5120 ft - Cutting

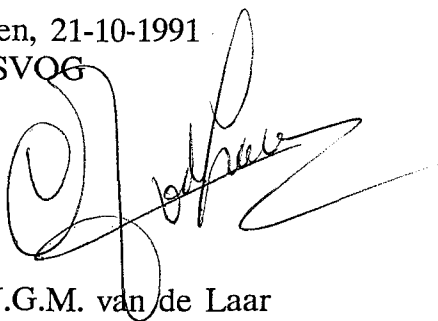
<i>Crassispora kosankei</i>	<i>Savitrissporites nux</i>
<i>Raistrickia saetosa</i>	<i>Cingulizonates loricatus</i>
<i>Densosporites sphaerotriangularis</i>	
<i>Lycospora</i> spp.	<i>Calamospora</i> spp.
<i>Florinites</i> spp.	

5170 ft - Cutting

Crassispora kosankei
Densosporites sphaerotriangularis
Lycospora spp.
Calamospora spp.

Relatively poor and badly-preserved sample!

Heerlen, 21-10-1991
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