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# Minutes

## of the 47th Meeting of the ICCP held at Kraków, Poland August 20 to 26, 1995

by
Zuleika Carreta CORREA DA SILVA,
General Secretary

## 1. General Course of the Meeting

The 47th meeting of the ICCP took place in Kraków, Poland from August 20 to 26, 1995. It was attended by the President, Dr. Alan Davis, 39 ICCP members (21 Full Members and 18 Associate Members) and 26 guests from 20 countries. The meeting was organized by the Faculty of Geology, Geophysics and Environmental Protection and it was officially opened by the Vice-Rector of the University of Mining and Metallurgy, Prof. Miroslaw Handke. The President thanked the Chairman of the Organizing Committee, Prof. Dr. Barbara Kwiecinska and the staff members who helped in the organization of the meeting, and remembered that in 1974 the ICCP meeting took place also in Poland and was organized by Dr. Hamberger, Dr. Kwiecinska and others.

Following the Statutes § 6, the plenary confirmed the minutes of the 46th ICCP meeting held in Oviedo, Spain, from October 2 to 8, 1994, with the following corrections within the first paragraph: "It was attended by ... 34 Members (20 Full and 14 Associate Members) and 20 guests representing alltogether 18 countries."

During the Closing Ceremony Alan Davis, the Past President, gave a report about the activities which took place during his four years presidentship. Following our statutes this report will be published in FUEL. Also in the next issue of the News the full text of the report will be printed. After this last duty Alan Davis introduced the new President, Manuel Lemos de Sousa, to the Plenary.

## Apologies

Apologies for absence had been received from S.S. Crowley, N.H. Bostick and P. Lyons (USA), A.C. Cook, A.M. Depers, J.G. Bailey and G.H. Taylor (Australia), S.L. Bend (Canada), T. Moore (New Zealand), A.H.V. Smith (United Kingdom), M. Teichmüller, R. Wartmann and M. Steller (Germany), C. Papanicolaou and K. Christanis (Greece), E. Thomsen and H.I. Petersen (Denmark), H.S. Pareek and A.K. Warma (India), M.M. Marques, D. Flores and H.J. Pinheiro (Portugal), M.V.B. Ade. and C.V. Araujo (Brazil) and H. Achilles (The Netherlands).

## Treasurer's Report

In the absence of the Treasurer, Prof. Dr. Duncan Murchison, the President reported that the accounting period is three weeks short of the full 12 months, viz. 23.08.94 to 31.07.95. The total balance is £ 16856.85 what shows a fall in comparison with the 1994 total (£ 19015.56).

As Prof. Murchison was not able to attend the last three meetings (Crete, Oviedo and Kraków) and because he has not sent the dues notices to the members it was asked if he still wants to continue as Treasurer. The President said that Prof. Murchison has done a very good work as Treasurer but he has had problems during the last years and if another Full Member is willing to serve as Treasurer Prof. Murchison will leave the position.

## Elections

The following elections were called during the year.

For **President** of ICCP 62 valid votes were cast

| | | |
|---|---|---|
| M.J. Lemos de Sousa | 36 votes | (58%) |
| Alan Cook | 25 votes | (40%) |
| Void | 1 vote | ( 2%) |

Prof. Dr. Lemos de Sousa was elected as President of ICCP.

In the election for **Vice-President** 62 valid votes were cast

| | | |
|---|---|---|
| Barbara Kwiecinska | 49 votes | (79%) |
| Cornelia Panaitescu | 8 votes | (13%) |
| Void | 5 votes | ( 8%) |

Prof. Dr. Kwiecinska was elected as Vice-President of ICCP.

In the election for **Chairman of Commission 3** 74 valid votes were cast

| | | |
|---|---|---|
| Judith Bailey | 43 votes | (58%) |
| Rosa Menendez | 30 votes | (40%) |
| Void | 1 vote | ( 2%) |

Dr. Bailey was elected as Chairman of Commission 3.

For **Secretary of Commission 2** 78 votes were cast

| | | |
|---|---|---|
| Willem Fermont | 48 votes | (61%) |
| Carla Araujo | 30 votes | (39%) |
| Void | 1 vote | ( 2%) |

Dr. Fermont was elected as Secretary of Commission 2.

The names of Prof. Lemos de Sousa, Prof. Kwiecinska, Dr. Bailey and Dr. Fermont were offered for confirmation to the plenary.

At the end of the 1995 meeting the **ICCP Council** has the following composition:

| | |
|---|---|
| **President** | Prof. Dr. Manuel J.Lemos de Sousa |
| **Vice-President** | Prof. Dr. Barbara Kwiecinska |
| **General Secretary** | Prof. Dr. Zuleika C.Corrêa da Silva |
| **Treasurer** | Prof. Dr. Duncan Murchison |
| **Editor** | Prof. Dr. Monika Wolf |
| **Commission 1** | |
| Chairman | To be elected |
| Secretary | Dr. Walter Pickel |
| **Commission 2** | |
| Chairman | Prof. Dr. Wolfgang Kalkreuth |
| Secretary | Dr. Willem Fermont |
| **Commission 3** | |
| Chairman | Dr. Judith Bailey |
| Secretary | Dr. Rosa Menendez |

## Forthcoming Elections

Elections for the following Council positions will be held before the next ICCP meeting:

General Secretary
Chairman of Commission 1

In accordance with the statutes II.c.ii. the Council nominated the following candidates for the position of **General Secretary** whose names were aproved by the Plenary Session:

Prof. Dr. Zuleika C.Corrêa da Silva
Prof. Dr. Monika Wolf

For Chairman of Commission 1 the Council nominated two candidates and one was nominated from the floor of the Plenary Session. Therefore, the candidates for the position of **Chairman of Commission 1** are the following:

Dr. Alan Cook
Prof. Dr. Claus Diessel
Dr. Krystyna Kruszewska

## Membership

The following Associate Members were elected to **FULL Member** of the ICCP:

Dr. Petra David (The Netherlands)
Dr. Maria Angeles Gomez-Borrego (Spain)
Dr. James Hower (USA)
Dr. Harry Veld (The Netherlands)
Mrs. Angelika Vieth-Redemann (Germany)

The following were elected to **ASSOCIATE Members**:

Vivien Mary du Caan (South Africa)
Janet Dehmer (Germany)
Lila Wanda Gurba (Australia)
Raphael Javier (France)
Anna Jurezak-Drabek (Poland)
Barbara Ptak (Poland)
Jaroslawa Szwed-Lorenz (Poland)

## Thiessen Medal

The Thiessen Medal was awarded this year to Prof.em. Dr. Monika Wolf "for her outstanding work in the application of organic petrology to regional geological mapping, environmental problems, and the characterisation of lignites, oil shales and bituminous coals". Prof. Wolf was always engaged on the work of brown coal and bituminous coal macerals nomenclature, was elected Chairman of Commission 1, General Secretary and President of ICCP and currently is the ICCP Editor.

The Laudatio was read by Prof. em. Dr. Claus Diessel on behalf of the Thiessen Award Committee and the Medal was presented by Dr. Alan Davis.

## ICCP archives

The General Secretary has been working in the organization of the ICCP archives that are stored in the Technical University of Aachen according to the decision of the 1994 ICCP meeting.

## Social programme and excursion

On Sunday, August 20, a social get-together evening was held on the main hall of the building of the University of Mining and Metallurgy.
On Tuesday, August 22, a sight-seeing tour to the historic centre of Kraków, including the old building of the Jagiellonian University, nowadays Copernicus Museum, and the Royal Castle Wawel.
On Wednesday, August 23, a visit to the Tyniec Monastery was followed by an Organ Concert in the Monastery Chapel.
The Conference Dinner was held in the Grand Hotel on Thursday, August 24.
On Friday, August 25, after the plenary session the participants visited the Salt Mine and Museum at Wielicza.
The excursion, held on Saturday, August 26, reached the Tatra Mountains and the tour around the lake Oko Moskie was preceded by a luncheon.

## Future meetings

The **next meeting** of ICCP will take place in Heerlen, The Netherlands, on September 08 - 14, 1996. Invitations have been already sent to all members of the ICCP. Further enquiries should be addressed to:

Dr. Willem J.J. Fermont
Geological Survey of the Netherlands
P.O. Box 126
NL 6400 AC Heerlen, The Netherlands
Tel.: +31 45 - 576 37 63
Fax: +31 45 - 571 69 09
E-mail: orgchem@rgd.nl

The **1997 meeting** will take place in Wellington, New Zealand, at the last week of October. Invitations to host the 1998 and 1999 meetings in Porto (Portugal) and Bucarest (Romania) respectively, were approved by the plenary.

# 2. Reports of the Commissions

## 2.1 Commission 1: General Coal and Organic Petrology

Chairman: Prof. Dr. M.J. Lemos de Sousa
Secretary: Dr. W. Pickel

**WG Accreditation - Conducted directly by the President A. Davis**

Alan Davis summarized a "Report of the working group of the committee for the accreditation", written by A. Cook, A. Davis and A. Depers. The report contained a review of the working groups history, the statistical analysis of the 1993 and 1994 data and their validity for accreditation, a description of the statistical methods used and suggestions for the future of the accreditation program.

In contrast to former approaches by R. Kutzner, the group developed a method related to the Youden Rank Test, but extended to a total of six samples. The measure used, termed AUMSD (Average of the unsigned multiples of the standard deviation) is described in detail in the report by A. Cook et al., that is going to be distributed, as any report quoted in these short minutes with the full minutes of Commission 1 (and also available on request from the authors or the secretary of Commission 1).

Applying this method to the data available, most of the data were inside the limits and thus the analysts would be accredited. The accuracy calculated on the basis of the available data was higher than expected (for vitrinite reflectance in average 0.03%, for maceral group analysis 3%). A. Davis also reported that the application of other statistical methods, as the statistics supplied by ASTM or the Chi-square test used by Fermont & David provide comparable results.

On the basis of this evaluation A. Davis and A. Depers had after consultance with several council members distributed "provisional accreditation forms" to those participants who returned data inside the limits.

As refinements for the future A. Davis suggested the following points:

- statisticians should be involved in the evaluation process;
- analysts who want to be initially accredited should analyse a set of six coals. Re-accredition should be necessary every two years;
- for re-accreditation two samples should be analyzed; those who are now accredited provisionally, should apply for re-accreditation in 1996;
- the working group structure should be reviewed;
- accreditation data should be published.

W. Fermont summarized a report titled: "Report on the statistical evaluation of the ICCP-1994 accreditation exercise" by W. Fermont and P. David. The 1994 data of the accreditation group was statistically evaluated by using the chi-square test. The method also includes, in a second step of evaluation, a test on the quality of the samples (for detailed description of method and results, see full minutes of Commission 1).

Discussion: The first point of the discussion was , who is going to be responsible for the working group and it was finally suggested, that A. Cook and W. Fermont should discuss their methods and take also some professional statisticians advice into consideration. Further discussion covered the mode of accreditation, prices for accreditation, the possibility to include coke and SOM analysis, that were found to be up to now to vaguely defined to be included, and the structure (membership) of the working group.

For the future procedure it was decided on with no vote against, that:

- the accreditation committee consists of A. Depers as convener, A. Cook and W. Fermont who are going to be in contact over the best method of further statistical evaluation and the chairman and secretary of Commission 1.
- a new exercise will be run in 1996. Those ICCP-members, who were provisionally accredited will have to analyse two samples at the price of 25 US-$, those who apply for first time accreditation will have to analyse 6 samples at the price of 50 US-$ (additional participants from the same lab can take part at the price of 5 US-$, non ICCP-members at the price of 300 US-$). Time schedule for the exercise:

next issue of the ICCP-Newsletter: notification of the exercise

- till **January 31st, 1996**: analysts who want to participate, notify A. Depers
- till **March, 31st, 1996**: sample sets are distributed
- till **May 31 st, 1996**: analysis results have to be returned to A. Depers.

**Inertinite Editorial Group - M. Wolf**

M. Wolf reported on the progress of the inertinite editorial group. In contrast to the vitrinite classification there is no subdivision of the macerals planned. First drafts of the following sheets were ready for the meeting and to be discussed in the group during the meeting: Micrinite (M. Wolf), Macrinite (A. Vieth-Redemann), Inertodetrinite (C. Panaitescu) and Fusinite (W. Pickel). A first draft of the Sclerotinite Sheet (R. Wartmann) is in progress.

**Liptinite Editorial Group - W. Pickel**

W. Pickel presented the state of the art of the liptinite editorial group. He reported on the progress that was made and problems that had become obvious by discussion with M. Teichmüller prior to the meeting. It was agreed on, to put extra chapters on "changes during coalification" as notes into the sheets. A further problem was seen in the subdivision of resinite. As finally it was agreed, not to include colloresinite into the liptinite classification, a need to subdivide resinite, as suggested in several variations, could easily be excluded. As a further consequence fluorinite in the new classification will be described as a single maceral. It was further agreed on to include notes on transmitted light microscopy. W. Pickel will finish the 1st drafts of the liptinite classification with the help of M. Teichmüller and A. Davis, who volunteered to review the drafts critically.

**Vitrinite Editorial Group - M. Wolf, W. Pickel**

In addition to the classification already printed a series of microphotographs was presented and discussed to be used for the vitrinite sheets. It was decided, that some further photographs are needed and that the final version is going to be published together with the classification, as soon as the collection is complete.

**WG Standardization - Convener: W. Pickel**

The convener proposed that no further round robin on vitrinite was to be circulated prior to the publication of the vitrinite classification including photographs, as no progress in comparison to the last round robin could be reached without supporting photomaterial. As soon as possible after these are available, a ring analysis on vitrinite is to be started.

**WG Fluorescence - Convener: S. Bend, J. Quick**

A. Davis on behalf of J. Quick summarized the progress on the sheet "Fluorescence Microscope Photometry, Part II: Measurement of fluorescence spectra". The original proposal by K. Ottenjann had been modified by an American group (incl. C. Thompson-Rizer, J. Quick and S. Bend). With no vote against it was decided to circulate the proposal with a ballot sheet to the members of Commission 1.

**Micrinite**

On behalf of B. Faraj, who had been invited to give a short presentation of his studies on micrinite, but was not able to attend to the meeting, W. Pickel gave a short

information of the findings, based on informations, made available by Dr. Faraj[1]). These can be, in short, summarized as follows:

- micrinite in the samples studied was found to be kaolinite
- it is suggested that most of the micrinite occuring in coals is kaolinite.

The discussion focussed on two points. There was some doubt that the material described as micrinite was correctly identified. Most members agreed, that even the possible fact, that kaolinite appearing similar to micrinite could not be generalized at this point of progress to the statement, that all micrinite is formed by kaolinite. The contact with Dr. Faray will be continued.

**Further activities**

Ring analyses

A written proposal of J. Prado to increase the efficiency of round robin analyses and lower the costs was distributed to the attending members. Comments on this proposal should be sent to

Dr. J.G. Prado
Instituto Nacional del Carbón
Apartado 73, La Corredoria
33080 Oviedo
SPAIN
Tel: 34-8-5280800
Fax: 34-8-5297662

Coal Classification

M.J. Lemos de Sousa and A. Davis reported on progress in coal classification at ISO and the United Nations and presented "A Guide To Coal Resource Utilisation" (International Standard 1170) and a proposal to ISO for the Classification of Humic Coals for Resource Classification.

Dead line for the next issue of the ICCP NEWS is February 29, 1996!

1) for further information see for example: **Faraj, B.S.M. & Mackinnon, D.R. (1993):** Micrinite in Southern Hemisphere sub-bituminous coals: redefined as fine grained kaolinite. - Org. Geochem. **20 (6)**: 823-841.

## 2.2 Commission 2: Application of Coal and Organic Petrology to Geology

Chairman: Prof. Dr. W. Kalkreuth
Secretary: Dr. W. Fermont

**WG Environmental applications of Coal and Organic Petrology - Convener: J. Bailey, A. Depers**

In the absence of the conveners the report was presented by W. Kalkreuth.

A questionaire has been send out to 27 members of the working group. 15 members replied: 2 members withdrawn, 1 new member, 8 actively involved, 4 passively involved.

An atlas of photomicrographs has been started. A request for photomicrographs from ICCP members so far has been poorly supported. The current draft atlas volume consists of a documentation on studies undertaken in Australia. It was suggested to prepare the atlas jointly with TSOP.

A draft nomenclature for the classification of organic and inorganic substances in environmental studies was submitted by A. Depers and discussed at the meeting.

ICCP-members will be asked via the ICCP newsletter to submit extended abstracts for a second compilation of papers to be presented at the Heerlen Meeting.

During the next year a round robin sample will be send out to interested members.

**WG Basin Modelling - Convener: W.J.J. Fermont**

A final report on the exercise of the Kemperkoul well has been postponed until the Heerlen meeting. A new exercise will be started in 1995/1996 using geological and petrological data from the Western Canada Sedimentary Basin (Lower Cretaceous to Tertiary strata).

Willem Fermont resigned as convener. Harry Veld is the new convener.

**WG Coal Facies - Convener: G.J. Nowak**

The convener gave a presentation on last years activities. Little progress was made due to lack of response. During this years meeting it was suggested to prepare a white paper by members of the working group which will be presented at the next meeting of the ICCP.

**WG Thermal Indices/Fluorescence - Convener: B. Pradier**

The convener was absent. A presentation concerning the calibration of spectral fluorescence measurements was given by Dr. R. Barranger.

The proposed exercise will consist of:

a) The calculation of relative correction function of the photo-optical system by using a standardized light source.
b) Measurements of fluorescent Tasmanacae algae from Toarcian shales from the Paris Basin. A work group session was held to discuss the time frame of the exercise.

**WG Atlas on Dispersed organic matter - Convener: W. Kalkreuth**

The convener has prepared a draft for structuring the atlas and presented it during the session.

Several sheets concerning the atlas of Dispersed OM have been discussed. An editorial group was set up to work on parts of the atlas. Preliminary results are expected at the next meeting. First drafts will be prepared in May next year.

**WG Alginite - Convener: A. Cook**

In the absence of the convener the session was coordinated by W. Kalkreuth. A revised draft of the alginite sheets was discussed. The text parts of the sheets were approved by the members of Commission 2 with minor editorial changes including integration of additional data on Spanish and Canadian oil shales (provided by A. Borrego, L. Stasiuk and W. Kalkreuth). 22 valid votes were counted, 21 in favour, one rejection.

Future work will focus upon suitable micrographs for the sheets. The micrographs will be presented at the Heerlen meeting for final approval.

**WG Isolation of Organic Matter - Convener: J.R. Castaño**

A report on last years round robin (a source rock from the Western Canada Sedimentary Basin) was prepared and discussed at the meeting. Results showed large variations in vitrinite reflectances and in petrographic composition. It was suggested to rerun the samples with a clearly defined classification scheme accompanied by micrographs in order to achieve a better agreement amongst participants on the various organic components.

## New Initiatives

**Pseudovitrinite Working Group**

A proposal to study rank variations in basin analysis as they relate to Ro levels in pseudovitrinite was suggested to the chairman of Commission 2 by L. Gurba and H. Read, Australia. Because of time limitations this proposal could not be discussed during the allotted time in Kraków and will instead be discussed at the next meeting in Heerlen.

## 2.3 Commission 3: Application of Coal Petrology to Utilization

Chairman: Prof. Dr. Claus Diessel
Secretary: Dr. Rosa Menéndez

**WG Automation - Convener: D. Pearson**

On behalf of David Pearson, Alan Davis read a letter listing the most recent advances of his team with excellent correlations between automatic and manual reflectance analysis. He is also dealing with his agreement for the election of a new convener after which, Petra David was proposed and elected as new convener of Automation WG.

Eugene Besedin gave a presentation on "Scientific and practical significance of image analysis applications in coal petrology". This was mainly directed to the typification of coals on the basis of their sulphur contents and mineralogy. Discussions were concerned with the distinction of aggregates and individual grains, and the presence of imperfections.

The new convener, after having contacted the outgoing one in order to have precise information about the WG, will send instructions for future work to all the members of the WG. Willem Fermont suggested to make a comparison of data obtained from automatic analyses and those from the accreditation exercise, using the same samples.

Members of Commission 3 who would like to participate in the working group Automation should contact:

Dr. Petra David
Geological Survey of The Netherlands
P.O. Box 126
6400 AC Heerlen
The Netherlands
Tel.: +31 45 - 576 37 44
Fax: +31 45 - 571 69 09
E-mail: orgchem@rgd.nl

**WG Combustion - Convener: J. Bailey**

In the absence of Judy Bailey, Rosa Menéndez acted as convener of this WG. The results of the 94/95 Ring Analysis involving 1 coal and 2 chars were presented. There were 9 participants in coal microlithotype analysis and 8 in the char analyses. The accuracy of the char counts was not considered acceptable.

After discussion it was concluded that more precise guidelines for the next exercise should be given. As Judy Bailey is the new Chairman of Commission 2 a new convener needs to be elected for the WG; however, it is proposed that Judy Bailey addresses the next exercise in order to avoid one year without any activity.

**WG Carbonization - Convener: R. Xavier**

Raphael Xavier gave very clear and precise guidelines for the next exercise. These were discussed by using slides, and they were mainly concerned with boundaries and intermediate situations in which it is not easy to make a decision, i.e. isotropic/anisotropic and isotropic molten/non molten. It was agreed not to include petroleum cokes. A set of pictures will be circulated with a very precise description of the structures to be considered and indications of the points to be counted. March 1996 will be the deadline for the reception of results.

**WG Reactive Inertinite**

Before starting the activities of this WG, Alan Davis was formally elected as convener of a new WG on Coal Blends Characterization.

Claus Diessel presented an overview of the work done by himself and other research groups on the role of reactive inertinite on carbonization. Important conclusions were outlined, such as the fact that inertinite reactivity can be manipulated by process variables and the relevance of the amount of inertinite present, rather than its origin. Extended Minutes of Commission III will report on this lecture in detail.

Krystyna Kruzewska showed results concerning the calculation of percentages of reactive inertinite using a new formula. She recalculated the results of the 4th and 5th Ring Analyses, performed several years ago.

In the previous ICCP meeting (Oviedo, 1994) it was decided to re-orientate the activities of this WG towards combustion. The WG was officially closed and a new one on "Inertinite in Combustion" was opened.

During this year, the short term objectives of the working group and proposals for round robin analysis will be formulated. Everybody interested on the subject is invited to contact the convener of the working group:

Dr. Angeles Gómez Borrego
Instituto Nacional del Carbón, CSIC
La Corredoria s/n Ap. 73
33080 Oviedo
Spain
Tel.: 34-85-280800
Fax: 34-85-297662

# Abstracts

## of lectures and posters presented at the 47th ICCP Meeting at Kraków, Poland, August 20-26, 1995

### BITUMINOUS COAL DEPOSITS IN POLAND

Barbara Kwiecinska

University of Mining and Metallurgy, Al. Mickiewicza 30, Kraków, Poland

There are three bituminous coal basins in Poland:

1. Upper Silesian Coal Basin (USCB) - foredeep basin
2. Lower Silesian Coal basin (LSCB) - intramountainous basin
3. Lublin Coal Basin (LCB) - pericratonic (epiplatform) basin

The principal source material for Polish coal industry is the Upper Silesian Coal Basin, which is situated in the borderland of Poland and the Czech Republic. The coal-bearing formations cover an area of 6100 km$^2$; about 4500 km$^2$ of which lies on the Polish territory and 1500 km$^2$ belongs to the Czech Republic.

The USCB is an orogenic basin formed in the foredeep of the Moravo-Silesian fold zone of the Variscides. The Carboniferous coal-bearing strata represent marine-paralic, paralic and continental sediments formed within the time-span late Visean - late Westphalian D. They are considered to be the molasse sediments of the Variscan orogenic system. The coal-bearing Carboniferous of Upper Silesia attains a thickness of 8 km in the west of the basin thinning out to 2.4 km eastwards.

The Upper Carboniferous productive deposits have been divided into the following lithostratigraphic series (Gabzdyl, 1994):

- Paralic Series - Namurian A
- Upper Silesian Sandstone Series - Namurian B and C

- Mudstone Series - Westphalian A and B
- Cracow Sandstone Series - Westphalian C and D

Tectonics of the USCB is related to the Asturian diastrophism. A specific tectonic zonality, revealing two distinct structural styles is precisely described by Kotas (1994).

A characteristic feature of the Carboniferous coal-measures of the USCB is the large quantity of coal seams. The number of coal beds, recorded in the sequences of all stratigraphic units in the area of their maximum thickness, is as much as 520. There is a full set of coal types ranging from a low rank non-coking power coal (subbituminous and high-volatile B-C bituminous) through coking coal (high-volatile A bituminous, medium volatile and low-volatile bituminous) to high rank special coal (semi-anthracite and anthracite).

The Lower Silesian Coal Basin (LSCB) is located in the Intra Sudetic Basin, the largest geological unit of the Sudetes. The coal-bearing strata display limnofluvial type of deposition. They are of Upper Carboniferous age. The LSCB is a depression 60 km long in the NW-SE direction and 30 km wide. Its area is about 1200 km$^2$, a half of which is coal-rich, comprising up to 60 seams of coal 0,6-3 m thick.

The division of the Upper Carboniferous sediments is as follows:

- Walbrzych Beds - Namurian A
- Bialy Kamien Beds - Namurian C and lower Westphalian A
- Zacler Beds - upper Westphalian A and Westphalian B
- Glinik Beds - Westphalian C and D
- Ludwikowice Beds - Stephanian A, B and C.

The outcrops of these beds lie nearly parallel to the syncline flanks resembling in shape a distorted horseshoe open to the south. The Walbrzych Beds (250-300 m thick) and the Zacler Beds (800 m thick) are the coal-richest and the most important for the coal industry.

Tectonics of the NE part of the basin is characterized by the presence of two synclines divided by the porphyry massif of Chelmiec. In the SE area there is a gabbro-diabase massif accompanying by fault whose displacement is 1000 m. In the Sudetic basin the fault structure prevails consisting of a dense network of normal, reverse or vertical faults with variable amplitudes. The orogenic movements promoted the volcanic activity. On the contacts of coal seams with magmatic intrusions there appear natural coke and semicoke, anthracite, mylonite and even partly graphitized coal (Kwiecinska, 1967, 1980). Medium to low volatile bituminous coals, semianthracite and anthracite are mined in the area of Walbrzych and medium to low volatile bituminous coals in the vicinity of Nowa Ruda.

The Lublin Coal Basin (LCB) is a pericratonic basin formed in the peripheral part of the East European Platform. The lower and upper Namurian show paralic features while the Westphalian exhibits limnic character.

The basin forms a belt of NW-SE direction, 180 km long and 20-40 km wide. Its area is about 4600 km$^2$. In the LCB, the coal-bearing Carboniferous sediments have been penetrated by several boreholes and up to now, the only one coal mine of "Bogdanka" is working. The LCB shows block-fault tectonics.

In the LCB, high to medium volatile bituminous coals are mined. Their occurrences show both vertical an regional variations. Generally the grade of coal metamorphism is not high.
In those, mentioned above coal basins the humic coals are distinctly prevailing over the sapropelic and liptobiolitic ones.

**Acknowledgements**

I would like to express my warm thanks to my colleagues W. Gabzdyl and A. Kotas for the permission of using their papers: W. Gabzdyl, 1994 - Geologia zlóz wegla. P.A.E.; A. Kotas, 1994 Coal-bed methane potential of the Upper Silesian Coal Basin, Poland. Prace PIG. CXLII.

## BROWN COAL DEPOSITS IN POLAND

Kazimierz Matl

University of Mining and Metallurgy, Al. Mickiewicza 30, Kraków, Poland

In Poland, brown coals have been formed during the following geological periods:

- Middle Triassic - as the fillings of the karstic voids in the ore-bearing dolomites (zinc and lead ores) of the northern margin of the Upper Silesian Coal Basin.
- Early and Middle Jurassic - the Silesia-Cracow Monocline, the Mesozoic surrounding of the Góry Swietokrzyskie (Holy Cross Mountains) and the Pomeranian Anticlinorium.
- Late Cretaceous - the North Sudetic Depression.
- Tertiary - the Polish Lowlands, the Carpathians and the Carpathian foredeep.

Almost all ranks of soft and hard brown coals are represented. Deposits of economical value are only the Tertiary soft brown coals of the Polish Lowlands being

the eastern part of the coal-bearing Middle European Depression.

In Poland, more than 150 brown-coal deposits have been found which contain $14*10^9$ ton of the geological resources. Almost throughout the Tertiary, from Late Paleocene to Late Miocene, the coal bearing deposits were formed being the richest in the Miocene.

The section of the Tertiary sediments and their lithological character are comparable with the analogous deposits of Lower Lusatia in Germany. The Lower and Middle Miocene seams are exploited. They correspond with the Miocene seams No 1 - 4 of Lower Lusatia.

## THERMAL HISTORY OF THE UPPER SILESIAN COAL BASIN - DETERMINING FACTOR OF COAL QUALITY AND COALBED METHANE DISTRIBUTION

Adam Kotas - Independent Geologist, SUBTERRA SERVICES

Coalification studies carried out by the author in the Polish Geological Institute were aimed at establishing methods of construction of coal quality maps showing regional changes of coal properties, mostly in virgin coal fields, explored by boreholes only. Due to the specific structure of the Carboniferous coal-bearing strata of the basin (numerous coalbeds distributed throughout sequences attaining in thickness to thousands of meters) the concept of a coalification field, defined by coal quality parameters sensitive to organic matter maturity changes, was developed, and a complex cartographic presentation of the field elaborated.

The study of the nature of quality changes, based on borehole sections that intersected different parts of the coalification field and different geological environments, resulted in setting up of a general model of the coalification changes with increasing depth expressed by Ro, $V^{daf}$, $M^a$, $Q^{daf}$, RI, SI, dilatation, $C^{daf}$, $H^{daf}$, and $T^{daf}$ in the Ro range 0.5-2.5 % as well as in differentiation of a zonal coal rank pattern defined by $V^{daf}$, $M^a$ and RI isometamorphic (coal maturity) surfaces.

The vertical coalification changes are not linear in character, their gradients and mutual relations are markedly varying throughout the basin area. Rank zones, representing the coalification field, are not bound to specific depth or stratigraphic horizons. They form an unique spatial system superposed discordantly on most structures of the Carboniferous strata. In general, the coalification field of the basin is characterized by gently undulated isometamorphic surfaces plunging to the East. There are two high positive coalification anomalies situated at the western corners of the basin, passing eastwards into lower amplitude local anomalies separated by a W-E trending coalification low. The most pronounced regional coalification low is situated in the eastern part of the basin.

The present coalification field of the Upper Silesian Coal Basin is the result of a complex thermal history of the Moravo-Silesian orogenic belt foreland. As a permanent record of a continuous thermal evolution, consisting most probably of several thermal events of different intensity, it is an excellent example of large-scale tele-thermal coal metamorphism. The post-inversional thermal overprint does not allow for a detailed evaluation of temperature gradients during the basin's subsidence and burial. It is also difficult to previsely differentiate burial and post-inversional parts of the field. The recorded paleotemperature gradients, expressed by Ro, are very variable, both in the vertical direction and over the basin area.

The rank distribution of Upper Silesian coals depends almost totally on organic matter maturation phenomena, hence, it reflects the present coalification field of the basin. The generation of methane during the coalification process is also controlled by thermobaric conditions, but the distribution of this gas in the Carboniferous strata is in the Upper Silesian Coal Basin heavily affected by the erosional history and hydrodynamic conditions during and after the inversion of the basin. This fact contributes to the complexity of exploration and recovery of coalbed methane in Upper Silesian coal fields.

## CATALYTIC HYDROGENATION OF THE LOW RANK COAL OF KOSTOLAC (SERBIA) INTO LIQUID FUELS

B.R. Aleksic[1] , M.D. Ercegovac[2], B.Z. Markovic[1], O.G. Cvetkovic[3], B.D. Aleksic[1], T.L. Glumicic[3] and D.K. Vitorovic[1]

[1]IChTM, Center of Catalysis and Chemical Engineering, Belgrade
[2]Faculty of Mining and Geology, University of Belgrade
[3]IChTM, Center of Chemistry, Belgrade

Investigating the possibilities of increasing the efficiency of utilization of low rank coals a study of coal conversion into liquid products by direct catalytic hydrogenation has been undertaken. The soft brown coal from "Drmno" field of Kostolac mines characterized by huminite reflectance of 0,27 $\pm$ 0,03 % Ro, ash content of 29 wt%, carbon content of 66,05 wt%, and volatiles of ca. 58 wt%, was submitted to liquefaction in a batch reactor. The effect of reaction parameters both on the yield and the nature of liquefaction products was studied varying the temperature in the range of 365-440°C, the pressure

from 13,5 to 16,5 MPa and the duration of the process from 1 to 8 hours. Changes in petrographic composition of the coal were examined by microscopic analysis of the solid liquefaction residues. The nature of the changes observed both in the organic and the mineral components of the coal grains were used to correlate the experimental conditions with the degree of coal hydrogenation.

A good reactivity of the chosen soft brown coal was observed. The yields of liquid products which could be used as liquid fuels varied from 23 to 64 % (dry ash free basis). Conversion rate is 80 - 86 %. These results were close to the previously reported bituminous coal liquefaction yields (1).

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## THE FLUORESCENCE MICROSCOPY OF LOW RANK COAL HUMINITES AND VITRINITES

Bend, S.L.[1] and Kosloski, D.M.[2]

[1]Dept of Geology, the University of Regina, Regina Sask., S4S OA2 Canada

[2]Norcen Energy Resources Ltd. 715 5th Ave., S.W Calgary, Alta. T2P 2X7 Canada

Coal maceral fluorescence is an important petrographic characteristic, but for many petrologists this characteristic remains underutilised except for the examination of liptinite macerals. This is largely due to the general perception that fluorescence is predominantly a characteristic of the liptinite macerals. It is unfortunate that this general belief is based upon traditional petrological practices, rather than the true inherent properties of the macerals themselves.

The photo-oxidative change in vitrinite/huminite fluorescence (alteration), is a phenomenon that effects most coals when conducting fluorescence microscopy with dry objectives in air. It has been demonstrated by others (e.g. Davis et al. 1990) that even the use of immersion media (i.e. oil, glycerin or water) does not prevent fluorescence alteration form occuring. In an attempt to standardise the practice of fluorescence quantation, when using a dry objective in air, the common tendency is to perform the analysis 3 minutes after the onset of irradiation. Unfortunately for most low rank coal, this typically represents either a period of rapid change in emission characteristic (Bend and Kosloski, 1995) or an emission intensity minimum which may be close to the detection limit of the microphotometer.

The use of nitrogen in conjunction with a dry objective eliminates fluorescence alteration, yields a higher fluorescence intensity and provides a more stable experimental basis for the utilization of vitrinite/huminite fluorescence as a diagnostic characteristic. However, this approach is insuffient on its's own. Reducing, or eliminating, the extent of exposure to atmospheric oxygen during sample preparation is also of vital importance. In our laboratory all coals are crushed and seived under nitrogen and this has also benefited our fluorescence microscopy.

The improvement in image quality when conducting fluorescence microscopy is such that subtle variations in morphology are apparent in low rank coal huminites and vitrinites. Our studies show that fluorescence can be an important characteristic for describing the physical properties of low rank coal huminites/vitrinites and also provide a highly sensitive method for the detection of low rank coal oxidation.

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## ORGANIC MATTER OF THE PUERTOLLANO OIL SHALES: MATURATION AND PALAEOENVIRONMENTAL CONDITIONS

A.G. Borrego[1], H.W. Hagemann[1], J.G. Prado[2], M.D. Guillén[3] and C.G. Blanco[2]

[1]Lehrstuhl für Erdöl und Kohle, RWTH Aachen, Lochnerstraße 4-20, 52056 Aachen, Germany

[2]Instituto Nacional del Carbón, CSIC, La Corredoria s/n. Ap. 73, 33080 Oviedo, Spain

[3]Facultad de Farmacia. UPV. Portal de Lasarte s/n, 01007 Vitoria, Spain

The bituminous series in the Puertollano oil shale field (central Spain) consists of three oil shale bands of different thickness (named PA, PB and PC from top to bottom). In this work, petrographic and geochemical analyses of the kerogens and bitumens from the three oil shales are carried out and the results interpreted in terms of variations in palaeoenvironmental conditions and maturity. The two lower bands (PB and PC) have a similar mineral and organic matter composition. In both of them most of the organic material is autochthonous and formed by lamalginite and telalginite (Botryococcus). The

PA oil shale is distinguished by a much higher mineral matter content, slightly higher proportion of allochthonous organic material (vitrinite+inertinite+ resinite) and lack of telalginite. Despite these differences the elemental composition of the kerogens and their thermal behaviour were very similar. Spectroscopic and chromatographic studies showed that the kerogens are made up of highly aliphatic weakly branched macromolecules as it is typically found in rocks rich in Botryococcus. Nevertheless, Botryococcus colonies forming telalginite just account for a small percentage of the organic components in the two lower bands. That indicates that lamalginite found in the Puertollano oil shales does not differ markedly in chemical composition from telalginite and that both could represent different growing states of the same alga, Botryococcus. The algae would have grown up in a stratified lake with anoxic bottom waters, lamalginite as laminar form and telalginite as planktonic form. The lack of telalginite in the upper band might indicate the inhibition of algal blooms either by an increase of the detritic input or by changes in the chemical composition of the water in the lake which could affect the living communities.

Some differences in the chemical composition of the kerogens from the three bands such as the proportion of oxygen functionality and the degree of substitution of aromatic structures indicated a lower maturity for the upper band compared to the two lower bands. That is confirmed by the fluorescence parameters of lamalginite which showed greenish-yellow hue in the lamalginite from the upper band and yellow hue in the lamalginite from the two lower bands. Nevertheless hopane and sterane maturity ratios showed a slight continuous increase in maturity from the uppermost oil shale to the lowermost oil shale. Despite the difference in maturity observed, the three oil shale bands can be regarded as situated at the beginning of the oil window.

## RANK DISTRIBUTION OF COALS FROM THE OYON BASIN (UPPER JURASSIC) OF PERU

E.R. Carrascal Miranda, and I. Suárez-Ruiz

Instituto Nacional del Carbón (CSIC), Ap. Co. 73, 33080 Oviedo, Spain

The Oyon Coal Basin is located in the Central part of Perú in the Lima Department. Its age is Upper Jurassic and according to geographical and geological criteria it can be subdivided in two sectors, Gazuna and Pampahuay. The first one covers 3 km² and it is in the NW part of the basin while the second is about 5 km² in area and it is in the SE. The two sectors are centered around two nuclei of very faulted and strongly tectonized anticlines.

The Oyon Formation which is representative of the sedimentary registry of this Basin, has an estimated thickness of 400 - 500 m and it constitutes the base on which the Cretaceous sediments of this area unconformably lie. The middle-upper part of the Oyon Formation contains the productive coal series which was identified in both sectors. This series has a thickness of 250 - 270 m and it is formed by sandstones and clay sediments among which 5 very faulted coal seams with a thickness varying between 0.8 and 2.5 m are interlayered. Exceptionally and in certain areas they can reach a thickness of 10 m. In all cases the central coal seams of the series are the biggest.

In general, coals from this basin are humic, banded and they are mainly composed of clarain and vitrain lithotypes. Their colour is bright black with a greasy lustre and they were generated in a marshy sedimentary environment. Their mineral matter content varies (ash content between 2 - 16 %) although exceptionally in some areas, they can present high levels (40 - 50 %). As for maceral composition, vitrinite is predominant constituting as much as 97 % (mmf) of the total identified organic compounds for the Gazuna sector. Liptinite (mainly resinite and sporinite) is very scarce (< 2 % mmf) for coals from the Pampahuay sector while it is rare appearing in vitrinized form in coals from Gazuna area. Inertinite is slightly more abundant (3 - 13 % mmf) in coals from the Pampahuay sector. In addition, coals from other areas located in the SW part of the Basin such as Cochaquillo, Cuta, Parquin and Cayash were analyzed. In all cases they show a similar composition to that described for coals from the other two sectors.

In relation to the rank distribution for this Basin, coals from the Pampahuay sector have reached an evolutionary stage corresponding to the low volatile bituminous coal rank with reflectances between 1,6 % and 2,0 % and with volatile matter contents of between 21 % and 13 %. The increase in reflectance values in some coals from this sector is directly related to the presence of an inverse fault of regional character which cuts across all the coal productive series. As for the Gazuna sector, in the West part of the Basin, its coals are more evolved (they are anthracites with weak anisotropy), presenting random reflectance values of between 2,24 and 2,52 % and volatile matter contents of 12 % - 8 %. The rank increase observed at the bottom of the productive series in this sector coincides with the proximity to the nucleus of the anticline structure. In addition, andesitic dikes which affect the coal beds contribute to an increase in rank in this zone.

Taking into account the data obtained from the two main sectors as well as the data from coals sampled in the SW of the Basin, it was observed that the rank variation shows a definite zonal distribution. Thus, a lateral increase in coal rank from East to West is observed. This zonal distribution is successively represented by the

evolutionary stages corresponding to the low volatile bituminous coal rank (Pampahuya sector), semi-anthracite rank (Gazuna sector and Cochaquilla areas), anthracite (Parquin and Cuta areas) and meta-anthracite (Cayash areas). The rank increase in the west part of the Basin is due to the presence in this area of intrusive stocks belonging to the eastern border of the Coast Batholith which was placed during the Upper Cretaceous - Lower Tertiary and also to the volcanic activity of the Lower Tertiary represented by the so-called Calipuy Volcanics.

It can be concluded that the higher rank reached by the coals of this Basin is due to the influence of the different phases of the Andean Orogeny as a consequence of the collision and the subsequent subduction processes of the Pacific Plate under the Southamerican lithosferic plate.

## AUTOMATED PETROGRAPHIC ANALYSIS OF MEDIUM RANK BITUMINOUS COALS

J.C. Catalina[1], D. Alarcon[1], and J.G. Prado[2]

[1]AITEMIN, Alenza 1, 28003 Madrid, Spain
[2]INCAR Ap. Co 73, Oviedo, Spain

A system has been developed to perform automatically the maceral and reflectance analysis of single seam coals in the subbituminous rank range.

The images are taken from the microscope with a high resolution 3 CCD video camera and an image processor card installed to a computer. The scanning stage and the focusing knob are also controlled by the computer via a GPIB interface.

A specific software has been developed to take the morphological information of the digitized image and to combine an expert system with an image processing system to diagnose the analyzed point. The system tries to reproduce the analysis procedure following that of a human operator who is required only for the preparation of the samples and start-up.

Currently it is possible to identify and obtain the reflectance analysis only of the Telocollinite, Gelocollinite or Desmocollinite separately, Corpocollinite is more difficult and normally is incorporated into the Telo- or Gelocollinite. Normal Vitrodetrinite is also identified, but can include broken Vitrinite in coals crushed by tectonic effects.

The maceral analysis is performed with good results in the Vitrinite and Inertinite groups. Liptinite analysis is more difficult in some coals highly spotted with little dark points due to clay accumulations or imperfect polish.

## PETROGRAPHICAL AND GEOCHEMICAL INVESTIGATIONS ON ORGANIC MATTER FROM PB-ZN DEPOSIT IN POMORZANY MINE, SE POLAND

Franciszek Czechowski[1], Barbara Kwiecinska[2], Maria Sass-Gustkiewicz[2]

[1]Institute of Chemistry and Technology of Petroleum and Coal Technical University of Wroclaw, 7/9 Gdanska Str 50-344, Wroclaw, Poland
[2]University of Mining and Metallurgy, al. Mickiewisza 30, 30-059 Kraków, Poland

The origin of organic matter in Zn-Pb sulphide deposits hosted in the dolomitized Middle Triassic limestones of Upper Silesia is still controversial. Generally, this organic matter is thought to be a later contamination, unrelated to ore-forming processes. Various interpretations have been proposed to explain the origin of the organic matter. They are described by Sass-Gustkiewicz and Kwiecinska (1994). In the presented work, based on geochemical results on molecular level, we discuss the new idea concerning the nature and origin of this organic material.

Macroscopically, two types of organic matter (OM) were distinguished:

1) black, breaking into small, prismatic fragments, with lustrous or glossy and conchoidal fractures, and
2) brownish-black, very friable, with dull fractures, disintegrating into loose, silt-like particles.

In reflected light both the bright and dull types of organic matter exhibit great homogeneity and lack of lamination, which is usually present in humic coals. Two varieties of macerals have been distinguished: eugelinite and porigelinite. Exinite and inertinite were not found. Reflectance ranges from 0.2% to 0.31% Rr, indicating a very low degree of coalification ('rank'), corresponding to the soft brown coal stage. Carbon and hydrogen contents vary between 62.7% to 69% and 3.9% to 4.9% respectively. H/C atomic ratios change from 0.67 to 0.91. Relatively high amounts of sulphur could be due to the presence of Zn, Pb and Fe sulphides dispersed in the OM. High amounts of Ca (8 wt%) and Mg (4.8 wt%) suggest that the OM studied is a dopplerite-calcium humate. From the samples free geolipids were removed by solvent extraction. For the determination of their molecular composition, the classic approach for geochemical investigations was conducted, involving column chromatography and gas chromatography/mass spectrometry. Designation of compounds to chromatographic peaks is based mainly on interpretation of their mass spectrometric data.

New Results: Amorphous OM occurring in the Pb-Zn deposit of the Pomorzany mine as coaly humic phase in

extension fractures and veinlets is highly oxidized. The data have demonstrated that the chemical composition of lipids extracted from the investigated organic material reflects extensive biological oxidation. Chemical constitution of free and methylated various organic acids, generated probably by multiple bacterial cultures having ability to oxidize various aliphatic and other structures, as well as composition of triterpanes, disregards thermal process in the organic material transportation, as thermal maturity of OM is low and can not be linked to hydrothermal processes.

Extensive biodegradation has a feature of the postmineralization phase of the deposit. We suggest, that source deposits for the migrated organic material (as soluble humic acids) with reported biodegradation are at or near the surface. Chemical composition of the geolipids is indicative for both, the terrestrial and aquatic environments of the source organic material. Part of this material, bacterial reworked in oxygen-rich water columns, could be transported by various ways to the deposit, where it was mixed with inflowing from different source acidic fluids (containing $H_2S$), which caused precipitation of humic matter.

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## PETROGRAPHY AND DEPOSITIONAL ENVIRONMENT OF COAL INTERCALATION WITHIN MARINE DEPOSITS (HRUSOV BEDS, UPPER SILESIA COAL BASIN)

Dariusz Gmur

Polish Academy of Sciences, Institute of Geological Sciences, ul. Senacka 1, 31-002 Kraków, Poland

Pendleian paralic deposits occur at Kozlowa Góra in the northern periphery of the Upper Silesia Coal Basin. They contain a thin coal seam associated with a seat earth, which are together set in marine mudstones. The storm deposits exist nearly 2 m above the seam. The coal seam is of high volatile bituminous A rank, according to the A.S.T.M. classification. In the eastern part of the outcrop (profile KG 13) the coal seam is up to 15 cm in thickness. Petrographically, clarain and vitrain are the dominant constituents. Vitrinite group macerals are the most frequent microscopic particles, particularly in the upper part of the seam section. Inertinite and liptinite occur more frequently near the top and bottom of the seam, and are also present in its middle part within a thin layer of dull coal.

Chemical analysis reveals that ash and sulphur occur in large quantity near the base and top of the seam. Depositional environment, inferred from Diessel's diagram and ash contents, was probably one of a wet forest swamp during mire development. The final phase of peat deposition was accompanied by transition to clastic marsh conditions, followed by terminal flooding of the mire by marine waters. The dull coal in the middle of the seam reflects temporary development of an open marsh with low mineral matter supply. Coal in the western part of the outcrop (profile KG 3) is characterized by decrease in vitrinite content and increase in ash. In this part the thickness of the seam is lesser (7.8 cm). The coal from profile KG 3 indicates predominance of marsh (open or clastic) conditions.

## PHYSICO-CHEMICAL PROPERTIES AND ULTRASTRUCTURE OF VITRINITES OF DIFFERENT RANK

A. Jiménez[1], F. Laggoun-Défarge[2], M.J. Iglesias[1] and I. Suárez-Ruiz[1]

[1]Instituto Nacional del Carbón, CSIC, Ap. 73, 33080 Oviedo, Spain

[2]Unité de Recherche en Pétrologie Organique, URA 724 du CNRS, Université d'Orléans, 45067 Orléans cedex 2, France

The study of vitrinite, the major maceral group for most coals, is difficult for several reasons. Vitrinite is defined petrographically on the basis of its reflectance and morphological textural features. As coal rank increases, the optical properties of vitrinite change. Nevertheless, variation in vitrinite chemistry may be due to factors other than differences in maturity. Vitrinites with the same textural and optical characteristics might not be homogenous with respect to their chemical properties. Moreover, the influence of the chemical structures present in the vitrinite on its reflectance is not clear.

The aim of this work is to study the relationships between the physico-chemical properties and the microscopic characteristics of this maceral group. Six vitrains made up almost exclusively of macerals of the huminite/vitrinite group (> 90 %), of different rank (ranging from subbituminous to bituminous coals), geological history and age were chosen. Problems related with the obtention of maceral concentrates by means of mechanical separation and possible modifications induced by demineralization were thus avoived.

The interpretation of the relations between the data obtained through exhaustive petrographic (reflectance measurements, maceral composition, fluorescence analysis), geochemical (proximate and ultimate analysis, Gray-King and Rock-Eval pyrolysis, FTIR, extract yield and composition), textural (real and apparent densities, porosity) and electron microscopy analyses as well as the study of coking properties provides an excellent characterization of this maceral group. Furthermore, a better understanding of structure, properties and the nature of vitrinite at different stages of evolution is obtained. The results show not only differences between samples of different rank but also between samples with fairly close rank. These differences are due to the different origin, evolution and processes that occured during evolution. In all cases the influence of the chemical composition is clearly shown.

## COAL AND CARBONACEOUS MUDSTONE AS OIL SOURCE ROCK IN JUNGGAR AND TURPAN-HAMI BASIN

Jin Kuili, Yao Suping, Wei Hui, Tang Yaogang, Fang Jiahu and Hao Duohu

Beijing Graduate School, China Univ. of Mining and Technology, Beijing, 100083

**Oil-generating macerals:** The main macerals of coal and carbonaceous mudstone for liquid hydrocarbon generation are fluorescent desmocollinite, bituminite, cutinite and suberinite, which have generated liquid hydrocarbons in low rank (VRr = 0.4 % - 0.6 %); on the basis of our study on hydrocarbon generate indications (e.g. oil drops, oil films and micrinite et al.).

We examined oil samples from these basins with CLSM. The reflectance of these vitrodetrinites is similar to that of coal or carbonaceous mudstone in coal measures of two basins; in addition, a lot of submicro-macerals and Jurassic microfossils were discovered under TEM. The conventional oil was short of these evidences.

**Oil-source correlation:** In order to verify the above conclusion, the different oils and aromatic fractions from source rocks including coal and carbonaceous mudstone were used for correlation by indicators, such as maturity indicator, standard compound, fluorescence spectrum and fluorescence lifetime fingerprint, from which it is the so-called laser-induced fluorescence method proposed by us (Jin Juili, et al., 1993). Moreover, the decreasing lifetime fingerprint may be characteristic for coal-generating oil.

**Simulation of hydrocarbon generation for individual macerals:** We made thermal simulation experiments using high Pressure Vessel under 6 temperature (150°C - 330°C) conditions together with quartz tube under 7 temperature (200°C - 400°C) conditions and analysed by PY-GS for the former, the micro-FT-IR as well as fluorescence microscopy for the latter. The results of which not only confirm that the above mentioned macerals can generate oil in an early mature stage, but also show individual maceral's oil-generating model.

**Oil-expulsion experiment:** Now, people focus their attention upon the problem of oil-expulsion from coal. Coal macropore volume of extracted and unextracted vitrain samples was compared based on Mercury Pressure Porosimetry together with the TEM and SEM. The results display the total pore volume increases after extract and the pore connection may be in series/parallel pattern except the isolated ones. That is to say, oil can be expelled. Moreover, the oil-expulsion experiment which the authors designed under 72 hrs., below 210°C and 18 atm. was further studied, and confirmed the above conclusion with evidence that expelled oil is that of pressed into coal.

**Sedimentary organic facies:** Sedimentary organic facies originated from coal facies, but they are different in that the former contains not only petrologic characteristics but also hydrocarbon potential of organic matter. Therefore, we have revised the coal facies (M. Teichmüller, 1962) based on geochemical parameters and sedimentary systems (the sedimentary systems of island plain have lake-swamp system and rive-swamp system). Four sedimentary organic facies for coal and carbonaceous mudstone were suggested: high moor facies, forest swamp facies, running water swamp facies and open water facies. The term of running water facies originates from C.H. Haymoba (1940).

Because macerals contain dual natures of both petrologic and geochemical characters, we may quickly set up organic facies based on maceral statistics. In the organic geochemical parameters, the sum of S1+S2 is closer between converted result based on hydrocarbon potential of oil-generating macerals and actual measured data by Rock-Eval. Similar conclusion in dividing sedimentary organic facies has been drawn using above two methods. The running water swamp facies zone may be the best for coal-generating oil.

## NATURAL COKE FROM THE CONTACT WITH DOLERITE; LA RASA MINE, TINEO, SPAIN

Barbara Kwiecinska[1], Marek Muszynski[1], John Vleeskens[2], Cerrit Hamburg[3]

[1]University of Mining and Metallurgy, al. Mickiewicza 30, 30-059 Kraków, Poland
[2]MINEX Comp., Breelan 16D, 1861 CE Bergen NH, The Netherlands
[3]ECN, Fuels Dept., Petten, The Netherlands

The aim of this paper was to carry out the comparative study of the natural coke from the Lower Silesian Coal Basin (LSCB) in Poland (Kwiecinska et al. 1992), and that from the Tineo Basin (TB) in Spain. The samples of altered coal and adjacent volcanic rock were collected in 1994 by B. Kwiecinska and J. Vleeskens from the La Rasa mine at Tineo (Asturias, Spain).

The coal seams occurring in the TB belong to the Westphalian Formation denoted as "Central Basin". The age of intrusive rocks is post-Stephanian almost certainly Permian. The TB is confined in the NW part by the uplift that separates the zones Cantabrica and W Asturia-Leon from the Hesperico massif (Melendez, 1943).

The coal samples were taken at several points from direct contact zone with dyke. They were recognized by macroscopic observations as typical natural coke and farther from the contact zone as slightly laminated, bright coal.

Optical microscopy (plane-polarized reflected and transmitted light, Zeiss and Opton microscopes), SEM-EDX, X-ray diffraction and chemical analysis were used for detailed examinations.

Natural coke from the La Rasa mine shows the following main features: pores, solid spheres and folds. Pores are observed rarely and they are very small, below 1 $\mu$m in diameter, irregular in shape, chaotically distributed. The spheres occur in colonies, about 1-2 $\mu$m in diameter and they are strongly anisotropic in reflected light. They resemble mesophase material consisting of semi-graphitic and graphitic spheroliths formed by deposition from the gas phase. The folds at the surface are more pronouced than in the LSCB samples. The size of the folds is in the range 1-1O $\mu$m. They display coarse flow anisotropic structure. In the samples we also observed anthracite fragments showing distinct microcrystalline mosaic structure. They occur as single fibres, sometimes in the form of ribbon-like aggregates. The reflectance measured as $R_0$max on spheroidal and ovoidal particles ranges from 9.6 to 12%. Anthracitic and not-coked, laminated parts display lower reflectance $R_0$mean = 2.3, 1.8 - 1.5%, respectively.

The volcanic rock from the contact zone with coal is a totally hydrothermally altered dolerite. The alterations consist in: argillitization, silification and carbonatization. The following features indicate a primary doleritic character of these rocks: apodoleritic structure type of groundmass, occurrence of numerous pseudomorphs after pyroxenes in the matrix and abundance of secondary anatase. High content of immobile $TiO_2$ confirms the basic character of the primary rock.

The volcanic rock was composed of numerous feldspar phenocrysts and the matrix consisting predominatly of fine (0.1 - 0.2 mm) feldspar laths (plagioclases) and pyroxene prisms. Feldspar phenocrysts (up to 2 mm in size) are replaced pseudomorphically by di-octahedral light 1M mica, kaolinite, montmorillonite, dolomite, sometimes quartz and pyrite. The feldspars of the matrix are replaced by the same minerals. On the other side pseudomorphs after pyroxenes consist of dolomite and/or siderite, anatase, and light 1M mica.

As follows from our observations volcanic rock which intruded coal seams in the TB was not acidic in type. This is the main difference in comparison with the porphyric type of rock described by Kwiecinska et al., 1992 from the LSCB. Other differences are as follows: reflectance of graphite-like crystallites is considerably higher ($R_0$max up to 12 %), pores are almost absent, folding of layers is very strongly developed in larger mosaics, revealing plastic stage. The colonies of spheroliths are very peculiar, not observed in natural coke from the LSCB. We can confirm earlier suggestions (Vleeskens et al., 1994) that the coaly matter from the TB was already more matured than coal from the LSCB when the magma intruded. The former could be in hard, bituminous stage.

All the results indicate that the temperature of alteration of coals from the TB was much higher than in the case of acidic type of magma. It could be even higher than 800°C.

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## THE EFFECT OF METAMORPHISM AND PETROGRAPHIC COMPOSITION ON THE DIFFUSION OF GASES IN HARD COALS

Aleksandra Marecka, Barbara Kwiecinska

University of Mining and Metallurgy, al. Mickiewicza 30, 30-059 Cracow, Poland

The paper is an attempt at a more detailed recognition of the effect of the degree of metamorphism and changes in the petrographic composition of hard coals on the diffusion process of gases in the structure of a coal sorbent, on the example of coals from the Lower Silesian Coal Basin (LSCB). Special attention is given to the optical properties of the coals. Samples for investigations were collected from the Walbrzych mine, 430 seam (Zacler Beds); Thorez mine and Victoria mine, 307 seam (Zacler Beds).

Both, the nature and the distribution of the petrographic components in coal are of great importance. In the case of high rank coals, the degree of the transformation of exinite is substantial. The correct recognition of this group of macerals is rather difficult. The examined coals show great homogeneity of petrographic composition; for example the contents of vitrinite and inertinite in the coal samples are respectively: 82.0 - 83.5% and 14.5 - 15.0% in coal from the Walbrych mine; 80.4 - 83.0% and 16.5 - 18.8% in coal from the Thorez mine; 73.7 - 83.2% and 16.4 - 21.9% in coal from the Victoria mine. The content of mineral substance falls within the limit 0.4 - 4.2%. The reflectivity of vitrinite, measured on telocollinite particles, varies from 0.94 - 2.2%, which places these coals in the class of medium to low volatile bituminous coals.

The type of coal (proportion of the different petrographic and mineral components) and the degree of metamorphism are the essential factors determining the physico-chemical properties of hard coals. From the point of view of their structure coals represent a very complicated substance.

Investigations of low-pressure sorption and diffusion of gases by a porous solid are one of the basic methods, enabling the study of these phenomena in the aspect of the natural properties of hard coals. Under the scheme of experimental studies there have been determined the sorption equilibria and the sorption kinetics of $CO_2$ and $CH_4$ on coal sorbents of different capillary structure of pores. The measurements were performed by the volumetric method, at about the ambient temperatures and pressures up to 0.1 MPa.

The results of earlier investigations show a distinct effect of the degree of metamorphism on the process rate and the sorption capacity of hard coals. The observed considerable differences in the properties of the coals may be associated with changes in the degree of their internal surface development and various fractions of micropores. Hence, anthracite coal with a strongly developed system of micro- and submicropores is characterized by a very slow sorption and desorption $CO_2/CH_4$ in spite of its relatively high sorption capacity.

The nature and the degree of transformations of coals may be responsible for such a differentiation of their properties. As it is known, the anthracites reveal higher ordering of their structure as we can see from the samples of Walbrzych mine.

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## HYDROCARBON POTENTIAL OF THE LOWER COLORADO GROUP OF THE WESTERN CANADA SEDIMENTARY BASIN AND ITS RELATIONSHIP TO PALAEOENVIRONMENTAL CHANGES IN THE CENOMANIAN - TURONIAN WESTERN INTERIOR SEAWAY

Barbara Mösle[1], Martin G. Fowler[2] and Wolfgang D. Kalkreuth[2]

[1]Lehrstuhl für Geologie, Geochemie und Lagerstätten des Erdöls und der Kohle, RWTH Aachen, Lochnerstr. 4-20, D-52056 Aachen, Germany

[2]Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada, 3303-33rd Street N.W., Calgary, Alberta, Canada T2L 2A7

The Cenomanian to Turonian age strata of the Colorado Group of the Western Canadian Sedimentary Basin comprises three formations. In ascending order, these are the Fish Scales, Belle Fourche and Second White Specks formations. Samples were taken from different wells in the southern part of the province Alberta. The sediments are immature with respect to hydrocarbon generation, having a vitrinite reflectance of 0.40 - 0.55 % $R_o$.

In the wells located in the eastern part of the study area, Rock-Eval/TOC results indicate that the Second White Specks and Fish Scales formations contain type II organic matter, and have good to very good oil potential. The Belle Fourche Formation has type III organic matter, HI values generally less than 100 mg HC/g TOC and has some gas potential. In the wells located in the western part of the study area, Rock-Eval parameters indicate type II to III organic matter for all formations and a good to very good oil potential. Microscopic observations showed that in both areas and all formations the organic matter is dominantly of algal origin but varies between the formations in the degree of preservation. Data from the western part of the study area suggest that the Belle

Fourche Formation may potentially also be an oil source rock.

High concentrations of $C_{30}$ 4-desmethylsteranes and the n-alkanes and $C_{27}$ to $C_{29}$ sterane distribution pattern are typical of a late Cretaceous marine algal contribution to the organic matter.

Generally wells from the eastern study area show higher amounts of lamalginite and bituminite, lower pristane/phytane ratios, higher TOC and HI values in the Second White Specks and Fish Scales formations than in the Belle Fourche Formation. In comparison to this, samples from the western wells have similar amounts of lamalginite and bituminite similar pristane/phytane, TOC and HI values. However, there is still some systematic variation between samples from different formations, with for example the Belle Fourche Formation having higher pristane/phytane ratios and the Second White Specks Formation samples a homohopane distribution with $C_{35} > C_{34}$ values. The homohopane distribution of eastern samples cannot be examined in the same way because of their lower maturity.

The differences in the petroleum potential between formations and areas seem to be a result of different palaeoenvironmental conditions. In the eastern, the bottom waters were more oxygenated during the deposition of the Belle Fourche Formation than for the Fish Scales and Second White Specks formations as indicated by higher pristane/phytane ratios and less preserved algal remains. Hence the Belle Fourche Formation has lower TOC contents and HI values. In contrast, there appears to have been a more uniform depositional environment for the Colorado Group in the western part of the study area although bottom waters were still more oxidizing during the deposition of the Belle Fourche Formation. Higher HI values may indicate more restricted and anoxic conditions.

The varying oxygenation of the bottom waters during the sedimentation of Belle Fourche Formation, as indicated by TOC contents, HI values and lamalginite contents can be explained by a different sedimentation rate in the two parts of the study area. According to the palaeogeography the sediment supply to the Western Interior Seaway was most from the Cordillera in the west. The proximity to the sediment source and thus a higher sedimentaton rate favoured a better preservation of the organic matter in the west, so that the organic matter input was covered quickly by new sediments and reached the anoxic zone of the sediment relatively faster. The organic matter was not significantly diluted because of the better preservation of what reached the sediment. In the eastern area the sedimentation rate was low and hence most of the primary algal material was oxidized or reworked. This is in a very good agreement with the higher thickness of the Belle Fourche Formation in the west than in the east.

## THE RELATION BETWEEN THE RECRYSTALLIZATION STAGE OF THE DETRITAL QUARTZ AND THE COALIFICATION DEGREE IN THE MEDIUM AND HIGH RANK COAL COMPLEXES FROM ROMANIA

Costel Nedelcu, Cornelia Panaitescu

In the high rank coal complexes of the South Carpathians orogenetic areas from Romania it has been observed the existence of a relation between the recrystallization stage of detrital quartz and the coalification degree. Some coal complexes (Cozla, Pregheda-Chiacovat-Ostresu, Armemis-Raul, Lung-Raul Alb, Schela-Gorj, all of Lias age) are belonging to the alpine sedimentary cover of the Danubian Autochtonous (which is overlapped by Gettic Nappe) and other coal complexes into alpine sedimentary cover of the Gettic Nappe (Anina Lias age deposit). During Laramian Movements, when the Gettic Nappe overlapped Danubian Autochtonous, the coal complexes suffered structural geological, mineralogical and chemical changes. A little deposit, Baia Nuoa, was situated in a Carboniferous post tectonic basin.

In some deposits the rocks have been anchimetamorphosed (sandstones into meta-sandstones, clays into meta-clays, anthracites into meta-anthracites, etc.). In the Cozla and Anina coal complexes the detrital quartz from sandstones appears only partially polygonized and regenerated in amount of about 10 %. The coals from Cozla and Anina have a medium rank (bituminous coal Cozla: RmVi=0.9%, $V^{mc}$=36-34%, $C^{mc}$=02-85%, $H^{mc}$=5.30%, $O^{mc}$=9-3%, $Q^{mc}$=8400 kcal/kg; bituminous coal Anina: RmVi=0.90-1.1%, $V^{mc}$=29.4%, $C^{mc}$=86.4-89.0%, $H^{mc}$=4.8-4.2%, $O^{mc}$=8.8-6.2%, $Q^{mc}$=8200-8500 kcal/kg). In the sandstones associated with the semi-anthracites from Baia Noua (RmVi=1.61-2.10%, $V^{mc}$=20.0-12.3%, $C^{mc}$=88.4-91.0%, $H^{mc}$=4.4-4.2%, $O^{mc}$=7.0-4.7%, $Q^{mc}$=8500-8700 kcal/kg) the detrital quartz is polygonized and recrystallized in amount of 15-20%. In the quartzitic microconglomerates and sandstones of the semi-anthracites and anthracites deposit from Pregheda-Chiacovat-Ostresu (RmVi=1.60-2.75%, $V^{mc}$=9.9-4.0%, $C^{mc}$=91-94%, $H^{mc}$=4.3-3.2%, $O^{mc}$=3.15-1.30%, $Q^{mc}$=8500-8800 kcal/kg) the detrital quartz formed very small "pseudoveins" (0.01-1.0 mm). It is polygonized and recrystallized in amount of 50%. Also, the all detrital quartz formed a growth cement in sandstones. Usually, quartzitic-like mosaic regenerated structures formed in sandstones but the original textures have been preserved. In the metaconglomerates and metasandstones of the meta-anthracites (RmVi=4.4-7.5%, $V^{mc}$=1.13-0.70%, $C^{mc}$=94.0-98.0%, $H^{mc}$=2.5-2.02%, $O^{mc}$=0.8-0.2%, $Q^{mc}$=8800-7900 kcal/kg) deposit from Closani, Armenis and Schela-Gorj all quartz hase been regenerated, quartzitic-like mosaic structures and "pseudoveins" (1.00-20.00 cm in width)

formed. In these meta-anthracites pyrocarbono-natural coke-semigraphite associations have been formed.

## PETROLOGY AS A GUIDE TO ESTABLISHING AN ACCUMMULATION MODEL OF COAL SEAMS OF THE ZACLER FORMATION FROM THE LOWER SILESIAN COAL BASIN (SOUTHWESTERN POLAND)

G.J. Nowak

Polish Geological Institute, Wroclaw, Poland

The Lower Silesian Coal Basin is the smallest of the three Polish bituminous coal basins. It represents an intermontane basin, and is located in the Intrasudetic Basin, the largest geological unit of the Sudetes. The coal-bearing strata of the Lower Silesian Coal Basin are of Upper Carboniferous age. Within the basin, the youngest coal-bearing strata, the Zacler Formation, have the greatest lateral extent and economical significance. This formation is of Westphalian A, B and C age.

Coal samples of the Zacler Formation were collected from several localities in the Lower Silesian Coal Basin, though predominantly from mines and boreholes in the Walbrzych (northwest), Nowa Ruda (east) and Siupiec (southeast) regions of the Intrasudetic Basin. The coals studied range from high to medium volatile bituminous rank, ie. mean vitrinite reflectance (Rm) from 0.72-1.35%.

The petrographic composition of the studied coal seams forms the basis for determining the swamp types and coal facies. In general coals from the northwest region are characterised by low to high vitrinite contents, low to medium inertinite contents and a constant percentage of exinite. Coals in the eastern part of the basin have mostly high vitrinite contents and medium to high inertinite contents. Their exinite percentage is negligible. All of the studied coals in the southeastern area of the basin have moderate vitrinite content and contain high percentage of inertinite (dominated by semifusinite, fusinite and inertodetrinite). The exinite contents are constant in coals in this part of the basin. The environmental conditions of coal deposition were determined from the following petrographic maceral analysis indices: SF/F ratio = semifusinite/fusinite: VA/VB ratio = vitrinite A/vitrinite B; T/F ratio = total vitrinite/(fusinite + semifusinite); W/D ratio = (vitrinite A + fusinite + semifusinite)/(alginite + sporinite + inertodetrinite); IR ratio = (semifusinite + fusinite)/(inertodetrinite + macrinite + micrinite); S/D ratio = (vitrinite A + fusinite + semifusinite)/(alginite + sporinite + inertodetrinite + vitrinite B + vitrodetrinite); TPI ratio = (vitrinite A + fusinite + semifusinite)/(vitrinite B + macrinite + inertodetrinite).

Depositional environments in the peat swamps have been interpreted from the microlithotype composition of the coal seam profiles and were plotted on "facies triangles" and the tissue-preservation-index - gelification index (TPI - GI). Forest moors of telmatic and limno-telmatic zones predominate in the northwestern and eastern areas. In the southeastern region the coals also exhibit reed-moor facies. The results of the palynological investigations show that in the Walbrzych and Nowa Ruda regions *Lycospora* generally predominates and in the Siupiec area *Densosporites* predominates. On the basis of the maceral composition, two main facies and eight subfacies were identified: (1) vitrinite-fusinite facies, which can be divided into telocollinitic, desmocollinitic, telocollinitic-desmocollinitic, fusinitic-semifusinitic, duritic and trimaceritic subfacies, and (2) densosporinite facies, which consists mainly of trimaceritic and duritic subfacies. The variation in spore assemblage and petrological composition of the seams indicate that changes of environment were accompanied by changes of vegetation. The vitrinite-fusinite facies, high in vitrinite, is characteristic for the forest-moor environment (the Walbrzych and Nowa Ruda regions), where arborescent vegetation predominates. Densosporinite facies, high in inertinite and intermediate in vitrinite, are typical for reed-moor environments where herbaceous plants prevail.

## USE OF CARBOPETROGRAPHY IN THE ROMANIAN CARBON PRODUCTS INDUSTRY

Cornelia Panaitescu

University "Politehnica" Bucharest, Faculty of Industrial Chemistry, Fuel Laboratory, str. Polizu, 1, 78126 Bucharest

The carbon products composition and structure, as a result of raw materials nature and characteristics and of manufacturing technology, are responsible for their properties, i.e. their behavior in the utilization processes. Because the raw material for most of carbon products (graphite included) are carbonaceous materials, treated at different temperatures (with or without impregnation), it is of interest to make evident the structure both of each component and the whole aggregate, in the consecutive stages of physico-chemical transformations. Therefore we have used carbopetrography, with its quantitative and qualitative microscopical techniques, both for establishing the composition and structure of the intermediate and finished carboproducts and to control the accuracy in performing of different technical processes belonging to the manufacturing flow.

Some of the characteristic structural aspects of carbonaceous raw materials, intermediate and finished products, are presented on the microphotographs. They show: different types of petroleum coke, with its optically anisotropic textures in calcinated needle coke:

macro- and microstructures of electrode and anode samples and microstructures of tar pitch coke.

Conclusions: The advantages of these petrographic researches resulted in
- a better understanding of the influence of type - composition and structure - of calcinated petroleum coke and binder - coal tar pitch or binder paste - on the carbon electrodes characteristics (porosity, graphitisation degree, conductibility, strength);
- an improvement of the processing technology, in order to rise the carbon products performances.

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## THE INFLUENCE OF THE OPTICAL ANISOTROPY OF PITCH COKE ON THE COEFFICIENT OF THERMAL EXPANSION OF GRAPHITE

Anca Ileana Penu

University "Politehnica" Bucharest

This paper shows a relationship between the optical anisotropy of pitch coke and the coefficient of thermal expansion (CTE) of the graphitized blocks which are produced with different pitches. It must be specified that the only variable of the process was the quality of pitch, all other conditions were identical (petroleum-coke, binder content, technical conditions during mixing, pressing, baking and graphitizing).

The optical anisotropy was appreciated such as a proportional dimension of the coke types. The CTE of the graphitized blocks decreases (from 2.43 to $0.15*10^{-6}$ $K^{-1}$) with increase of the anisotropical unit dimension (from 4.12 to 8.46 $\mu$m).

Another important property is the porosity and its influence on the CTE is presented too.

## GEOLOGY, PETROLOGY AND GEOCHEMISTRY OF COAL SEAMS IN TRANSGRESSIVE SYSTEMS TRACTS; MIDDLE JURASSIC, NORTH SEA

H.I. Petersen and J. Andsbjerg

Geological Survey of Denmark and Greenland, Thoravej 8, DK-2400 Copenhagen NV

During Bajocian-Bathonian times alluvial plain environments and tidally influenced channels associated with back barrier environments and peat-forming swamps dominated the southern Sogne Basin in the northeastern part of the Danish Central Graben, North Sea (Johannessen and Andsbjerg, 1993). These deposits are recognized as the 50-100 m thick middle unit of the coal-bearing Bryne Formation in several wells. The present study focuses on the middle unit of the West Lulu-2 well.

A number of key surfaces have been recognized in the coal-bearing intervall in several wells in the Sogne Basin, and the sedimentary package can be divided into two sequences, A and B, where the deposits of sequence A represent a transgressive systems tract and the deposits of sequence B a lowstand and transgressive systems tract. The sediments of the highstand systems tracts have been removed by erosion.

The succession contains 5 coal beds ranging between 0.4-2.0 m thickness. Random vitrinite reflectances are between 0.78 % Rm and 0.89 % Rm indicating a rank of High Volatile Bituminous A (Petersen and Andsbjerg, submitted). Some of the coal beds can be followed over large parts of the Sogne Basin. The coal beds are interpreted to represent peat accumulation in back barrier/strand plain environments. Petrographic and organic geochemical analyses have made it possible to identify 6 coal seams with distinct compositions. These compositional changes are considered to be related to environmental alterations in the mires, principally in the level and stability of the watertable. Due to the coastal position of the mires, the watertable fluctuations were related to relative sea-level changes, and the seams thus have the potential to be of significance in sequence stratigraphic contents.

Two of the 6 coals seams (seams R1 to R2) represent peat formation during slow rates of base level rise in mires characterized by unstable and fluctuating watertables. The coals are in general characterized by relatively high contents of complex inertinite-rich microlithotypes, and low contents of pyrite (Petersen and Andsbjerg, submitted). In contrast, the precursor peats of seams T1 to T2 accumulated in waterlogged and anoxic conditions due to a continuously rising watertable caused by a rapid relative sea-level rise. The coals are dominated by vitrinite-rich microlithotypes, and considerable proportions of pyrite is common. The total sulphur content is high.

Geochemically the coals of seams T1 to T4 tend to have higher Hydrogen Indices, average extractability, HC yield, and thermally extracted and generated bitumen content (S1 + S2) than the R1 and R2 coals (Petersen et al., submitted). However, higher Pristane/Phytane ratios and the highest content of $C_{29}$ sterane is observed in the coals of seams R1 to R2.

Coal seams T1, T2, T3, T4 and R2 are situated within the transgressive systems tracts. Coal seam T1 is situated close to the correlative level to the maximum flooding surface of sequence A (Petersen and Andsbjerg, submitted). A sequence boundary is situated a few metres below seam R1, which is situated on top of the lowstand systems tract. Hence, the peat accumulated during the shift from base level fall to a slow base level rise, which periodically allowed the raste of peat formation to outpace the watertable rise. Seam T2 formed during a continuously high watertable caused by more rapid base level rise. The coal seam complex R1 and T2 are interpreted as a transgressive surface zone separating the lowstand and transgressive systems tracts of sequence B.

The correlative level to the maximum flooding surface of sequence B is believed to have been situated 3-4 m above the coal seam R2, T3 and T4 complex, but has been removed by erosion. The seams are laterally restricted and thick, corresponding to maximum rate of accommodation space creation towards the maximum flooding surface (e.g. Aitken, 1994; Flint et al., 1995). Coal seam R2 accumulated on top of the infill of a lagoon behind a protecting barrier during initial slow rise of base level allowing the peat to accrete above the watertable. Seams T3 and T4 were formed during accelerated watertable rise caused by increased relative sea-level rise towards the maximum flooding surface.

A third sequence boundary is situated approximately 1 m above seam T4.

Marine influence increases up through the succession culminating in fully marine conditions at the top of the Middle Jurassic succession. The coal seams R2, T3 and T4 are thus situated in the transgressive systems tract with the highest accommodation potential, before marine conditions are established.

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## EFFECT OF COALS AIR OXIDATION ON PETROGRAPHIC AND COKING CHARACTERISTIC

Georgeta Predeanu, Metallurgical Research Institute, Bucharest
Cornelia Panaitescu, University "Politechnica" Bucharest
Calim Dumitrescu, ITMS-Consultcarbo-srl Bucharest

Low temperature air oxidation of coals during long-term storage under ambient conditions, causes not only a substantial reduction of calorific value but also the diminishing of technological properties, swelling and plasticity. These effects contribute to the decrease of metallurgical coke yield, coke strength and coking rate and at the same time, to the increase of coke reactivity and coke breeze.

The weathering of coals depends on: rank, grain-size, air humidity and storage time.

The aim of this paper is to determine the relation between the degree of weathering, vitrinite reflectance and coking properties of some coals used in Romanian cokemaking industry.

It is well known that low-temperature oxidation of coking coals during storage or transportation can effectively destroy their coking properties. For the study, some different types of coals were chosen: high volatile (34 - 39 % d.b.), medium volatile (23 - 27 %) and low volatile (17 - 21 %). The storage time of almost each coal ranges between 0 and 60 days. The chemical technological and petrographical analyses of the coals reveal that as coal loses its caking properties due to more or less weathering, depending on its rank, becomes more inert in the coking process, with a resulting decrease in coke quality. Petrographical measurements (vitrinite reflectance) and typical micrographs showing the fracturing characteristic of weathered coals were done.

## MINERALOGICAL CHARACTERIZATION OF THE LOW-RANK BITUMINOUS COALS FROM THE UPPER SILESIAN COAL BASIN (USCB), POLAND

Slawomira Pusz[1] and Barbara K. Kwiecinska[2]

[1]Institute of Coal Chemistry PAS; Sowinskiego 5, 44-100 Gliwice, Poland

[2]Department of Mineralogy, University of Mining and Metallurgy; al. Mickiewica 30, 30-059 Kraków, Poland

The results of mineralogical and petrological studies of the low-rank bituminous coals from the USCB have been presented. The following analytical methods were used to recognize the detailed nature of mineral components in the studied coals: optical microscopy, scanning electron microscopy with wave lenght dispersive X-ray spectrometer (SEM-WDX), X-ray diffraction, Mössbauer spectroscopy, chemical and technical analyses, and low temperature ashing (LTA).

The major part of the inorganic matter is represented by clay minerals followed by iron sulphides, quartz and carbonates. Sulphates and other minerals occur in subordinate amounts.

Forms of occurrence of clay minerals and quartz suggest their syngenetic origin, while carbonates and sulphates are rather epigenetic. Pyrite has both syngenetic and epigenetic origin.

Detailed analyses of amount, distribution and modes of occurrence of minerals and their associations in the coals allowed the reconstruction of processes which introduced the inorganic matter into the coals seams. Three stages of its formation have been distinguished: early syngenetic, late syngenetic, epigenetic, and characteristic minerals have been identified.

Though the studied area is a single stratigraphic unit characterized by a uniform geological structure and containing only flame coals, two parts can be distinguished within it, the eastern and the western ones, whose coals are differentiated by the character of both the organic and the mineral matter.

The coals from the eastern region are less metamorphosed than from the western one. They contain more inertinite and less vitrinite and are characterized by the plant tissue better preserved in comparison with the coals from the western region. The content of total sulphur is also higher in the eastern part of the studied area.

There are differences in the mineral matter too. Clay minerals dominate in coals in the whole territory, but the distinguished regions are differentiated by the type and forms of carbonates, sulphides and sulphates.

In the eastern region iron sulphides are the most abundant phases after clay minerals. They are accompanied by Ca and Fe sulphates. Carbonates are almost totally lacking in these coals.

In the western area carbonate are the most important after clay minerals and they are followed in abundance by pyrite. Ca sulphates are subordinate, while Fe ones have not been found.

The differentiation of amounts, types and forms of minerals and also organic matter of coals, occurring in the eastern and western part of the studied area is clearly connected with the epigenetic stage of the USCB development.

Similarities in the composition of the parent material and the syngenetic mineralization combined with differences in the epigenetic one suggests that differentiation of the eastern and western regions began at the end of its syngenetic development and could be connected with the subsidence rate - different in each part of the studied area.

## PETROGRAPHIC AND CHEMICAL CHARACTERISTICS OF THERMALLY METAMORPHOSED COALS FROM THE SOUTHERN DONBAS, UKRAINE

H. Zhernova

Institute of Geological Sciences, National Academy of Sciences of Ukraine

It is established that the bituminous coal seams of the Southern Donbas basin have been affected by thermal metamorphism due to the intrusion of dikes and sills. The intrusion are considered to post-date the folding and faulting that took place at the end of the Triassic ($T_2$-$T_1$).

The coals from Lower Carboniferous rocks, practically unaffected by thermal metamorphism, are of medium volatile bituminous rank ($C^{o}o$ = 84-85%). The properties of thermally metamorphosed coals are caused by anomalous high temperature gradients.

Three main groups of the coals have been recognized taking into account the degree of their changes: weakly, medium and intensively transformed coals. The table gives some chemical data of thermally metamorphosed coals.

The intensively transformed coals were formed at their contact with porphyrite. The coal at the original contact was converted into a solid natural coke with fine coke mosaic, inertinite-rich bands and pyrite-rich bands. The mosaic structure of strongly reflecting, highly anisotropic units is the main constituent of natural coke. The

maximum reflectance in air of the coarser anisotropic domains is about 10,7 to 21,6 %, corresponding with that of domains in laboratory pitch cokes heated from 650° to 800°C. A new formed maceral - pyrocarbon ("nodul") is characteristic for these coals. Most of the "Nodules" are represented by spheric aggregates 20 - 50 mkm in diameter.

The medium transformed coals were formed under the condition when the coal seams situated in some distance from the source of heat which caused the partial plasticity. The maximum reflectance in air is 9,5 - 13,1 %. These coals are formed at a temperature near 650°C.

The weakly transformed coals appear to be almost unaffected by the intrusion. It is typical for the petrography and the chemical composition of the coal in these coal area in particular. However, the vitrinite and sporinite are more dark in colour and have higher maximum reflectance ($R_a$ = 7,8-9,0 %) in comparison with nonaltered coals. The results of micropetrographic and chemical studies of these coals are corresponding to the variations in reflectance ($R_a$ = 7,8-9,0 %) and temperature of formation of the coal up to 250°C.

| Range of transformation | $R_a$,% | $W^a$,% | $V^{daf}$,% | Y,mm | $Q^{daf}$, MJ/kg | $C^o_o$,% |
|---|---|---|---|---|---|---|
| weak | 7.8 - 9.0 | 0.5 - 1.0 | 21.0 - 28.4 | 5 - 15 | 35.9 - 37.2 | 85.9 - 92.3 |
| medium | 9.5 - 12.2 | 0.8 - 1.0 | 19.1 - 8.0 | - | 36.1 - 36.7 | 89.3 - 92,0 |
| intensive | 13.0 - 19.6 | 0.2 - 1.5 | 13.6 - 4.6 | - | 31.1 - 35.0 | 88.3 - 95.3 |

## Call for Nominations for the Reinhardt Thiessen Award

This will be the only notice calling for nominations of candidates for the 1996 Reinhardt Thiessen medal award. The award is made for individuals who have made outstanding contributions in the field of coal or organic petrology. Any person of high standing in the field is eligible for the award; ICCP membership is not a prerequisite. Only Full Members of the ICCP may submit a nomination.

The award is made by the ICCP Council acting on the recommendation of the five members of the Thiessen Award Committee and will be presented at the 1996 ICCP meeting to be held in Heerlen (The Netherlands) in September. The Committee invites you to send your nominations to: Dr. Alan Davis, Chairman of the Reinhardt Thiessen Award Committee, Coal and Organic Petrology Laboratories, 105 Academic Projects Bldg., University Park, PA 16802, USA (Fax: 1-814-865-6544). Letters of nomination should provide the reasons for and justification of the proposal and must be received by **March 1, 1996** at the latest.

## Informations

1. Limited copies of the ICCP Working Group **"Environmental Applications of Organic Petrology"** White Paper and Abstracts Volume are still available and can be obtained from:

Aivars Depers
Department of Geology
University of Wollongong, N.S.W. 2522, Australia
Fax: +61.42.21.4250
E-mail: A. DEPERS@UOW.EDU.AU"

2. The ICCP Working Group on **"Environmental Applications of Organic Petrology"** is compiling an atlas of photomicrographs dealing with the identification and naming of organic and inorganic constituents in environmental type samples. If you have photomicrographs of material which you think may be suitable in an atlas, then please forward slides or prints or both to:

Aivers Depers
Department of Geology
University of Wollongong, N.S.W. 2522, Australia.

All original material will be returned after a draft form of the atlas has been compiled. The Working Group intends to publish the atlas and is seeking financial support from interested companies and institutions.

3. A proposal was made from A. Davis to install an ICCP mailbox in the Internet, either together with TSOP or alone. A handout from M. Reinhardt was distributed during the last meeting, containing proposals for a possible structure. The general interest was expressed by various speakers and M. Reinhardt is in charge to inquire in more detail upon the possibilities with the assistance of W. Kalkreuth and W. Pickel.

## Miscellaneous

### First Walter A. Bell Memorial Symposium (Sydney, Nova Scotia, May 28-June 1, 1995)

An international symposium on Carboniferous paleobotany and coal geology was held in Sydney, Nova Scotia, in the heart of Nova Scotian coal country. The symposium honored the late Dr. Walter A. Bell, pioneering Carboniferous coal geologist and paleobotanist, who spent his entire career with the Canadian Geological Survey. He was the Director of the Canadian Survey from 1949-1953.

The focus of the symposium was on Euramerican Carboniferous paleobotany and coal geology and an attempt at the resolution of coal-stratigraphic correlations across the Atlantic. Twenty-five papers were delivered on a wide range of subjects including Canadian palynology, paleobotany, and coal geology; systematic work on major groups of fossil plants (herbaceous lycophytes, walchian conifers, tree ferns, and seed ferns); coal geology of the Kladno coalfield, Bohemia; whole-plant associations and *in situ* spores in permineralized plant fossils; historical aspects of Canadian Carboniferous geology; new finds of coal-ball plants and lycophyte and conifer forests in Atlantic Maritime Canada; biostratigraphic studies of Euramerican micro- and megafloras; the range of plant megafossils from the Mississippian and Pennsylvanian Systems of the Appalachian region; modern phylogenies and plant homologies; the significance of Bell's Fundy Basin; the morphological aspects of the lycophyte, *Omphalophloios* David White 1898; and the fossil-plant record and global climatic change. The interrelationships among these diverse topics by international experts provided unusual breadth and depth to the Bell Symposium.

A display of plant and animal fossils from the world-famous Joggins Carboniferous section by Professor Laing Ferguson (Mount Allison University, New Brunswick) added to the focus of the symposium. Also workshops on coal-ball plants (Paul Lyons and Michael Millay, coordinators), Canadian Carboniferous palynology (Graham Dolby, coordinator, Calgary, Canada), and compression-impression fossils of the Carboniferous of Canada (Erwin Zodrow, coordinator) extended the oral presentations, as did a field trip to Point Aconi, the highest part of the onland Carboniferous section in Nova Scotia. Participants were given an opportunity to collect plant megafossils from the roof shales of the Point Aconi seam, one of the richest collecting sites in Euramerica.

A parallel session on Euramerican stage boundaries chaired by C.J. Cleal (National Museum of Wales) led to progress on the recognition of the Bolsovian-Westphalian D and Westphalian D-Cantabrian stage boundaries in Canada, the United States, and Europe. Collections at Point Aconi also revealed the relative age of Cantabrian Nova Scotian and central Appalachian coal beds.

The symposium included an optional trip to historic Fortress Louisbourg, a partially restored French settlement in Cape Breton. This early 1700's settlement was one of the gateways to the New World and the site of battles between the French and the New Englanders.

The 1st Walter A. Bell Medal was presented to Dr. Peter A. Hacquebard (Fig. 1), Scientist Emeritus of the Canadian Geological Survey. Hacquebard is a pioneering coal petrologist and palynologist whose leadership led to the formation of a microfloral scheme for the Carboniferous System of Canada. This pioneering work, which was done with M.S. Barss of the Canadian Geological Survey, extended Bell's megafloral and faunal zonation schemes. The handcrafted, silver Walter A. Bell medal was presented to Hacquebard by Dr. Aureal T. Cross, Michigan State University, who is a friend and contemporary of Hacquebard. Hacquebard is a long standing ICCP member and also the recipient of the Reinhardt Thiessen Medal of the International Committee of Coal and Organic Petrology and the Gilbert H. Cady Award of the Geological Society of America.

The proceedings of the 1st Walter A. Bell Symposium will be published as a special issue of the *Review of Palaeobotany and Palynology* which is scheduled for publication by Elsevier Science in the spring of 1996.

The organizers announced that the 2nd Walter A. Bell Memorial Symposium will be held in 1999 in Sydney, Nova Scotia. The exact timing and further details will be announced in about two years.

Paul C. Lyons
U.S. Geological Survey

Erwin L. Zodrow
University College
of Cape Breton

### Catalog of Fossil Spores and Pollen

During the period 1957 to 1985 forty-four volumes of the *Catalog* plus four index volumes and two translation volumes were published. The catalog provides, in concise and standard format, illustrations, descriptions and other information for all taxa of fossil palynomorphs, except those covered by other catalogs or those of purely animal origin. A sizable portion of the literature is represented by these 44 volumes. *The Catalog* is a compendium of systematic information intended primarily for nomenclatural-taxonomic use. Nevertheless, it has been useful in obtaining a general view of the fossil spores and pollen characteristic of various parts of the stratigraphic column. The *Catalog* is a condensed library of palynological systematics, making it especially useful to palynologists where library facilities are limited.

There are no plans at this time to publish further volumes of the *Catalog*.

Now, for a limited period and while supplies last, the catalog is on sale for a fraction of its original price. Until recently, the cost to institutions for a complete set of the catalog (as described below) was $ 2,760.00. The price during this limited time offer is $ 685.00. The sets consist of printed Volumes 3-4 and 28-44 and the Indexes for Volumes 21-40 in a looseleaf format bound in sturdy plastic binders; the remaining volumes plus two indexes and two translation volumes are out-of-print but are included in the set as photocopies in spiral binders with soft covers. Individual printed volumes are available at the special price of $ 25.00, reduced from the recent institutional price of $ 85.00. There is an additional charge for packing and shipping, estimated to be about $ 90.00 for shipment within the U.S..

A second format, printed on card stock for filing is also available for 35 of the volumes. For information on this format please contact the address below.
Orders or further information in the form of a 27-page brochure can be obtained from:

Coal & Organic Petrology Laboratories
105 Academic Projects
Penn State University
University Park PA 16802, USA
(Tel.: 814-865-6544; Fax: 814-865-6544).

## Imprint

**Editorial management:**
Dr. Monika Wolf
Mergelskull 29
47802 Krefeld
Germany
Fax: +49-2151-561169

**Layout:**
T. Gleu, Aachen
R. Wuropulos, Aachen

**Regional coordinators:**

**Australia/New Zealand:**
Dr. R. Sykes
Institute of Geological & Nuclear Sciences
PO Box 30368
Lower Hutt
New Zealand
Fax: +64-4-5695016

**Southeast-Asia, Japan:**
Dr. A. Cook
Keiraville Consultants Pty. Ltd.
7 Dallas Street
Keiraville, N.S.W. 2500
Australia
Fax: +61-42-299624

**China:**
Dr. Wang Jie
China University of Mining & Technology
Xuzhou, Jiangsu 221008
People's Republic of China
Fax: +86-516-888682

**North America:**
Dr. St. Bend
Department of Geology/E.R.U.
University of Regina
Regina, Saskatchewan O82 S4S
Canada
Fax: +1-306-5855205

**South America:**
Dr. C.V. Araujo
Petrobras - Cenpes Divex/Segeq
Cidade Universitaria
Ilha do Fundao, Quadra 7
21910 Rio de Janeiro, RJ
Brazil
Fax: +55-21-5986799

**South Africa:**
Dr. R. Falcon
Falcon Research Laboratory
P.O. Box 41086
Craighall
Johannesburg
Republik of South Africa
Fax: +27-11-8839611 or 4843193

**Europe:**
Dr. Monika Wolf
Mergelskull 29
47802 Krefeld
Germany
Fax: +49-2151-561169

**Dead line for the next issue of the ICCP NEWS is February 29, 1996!**