

PETROLEUM GEOLOGISCHE KRING

KONINKLIJK NEDERLANDS GEOLOGISCH EN MIJNBOUWKUNDIG GENOOTSCHAP



PGK

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| Venue: | PGK's monthly lectures are held at the KIVI building, Prinsessegracht 23, Den Haag. Drinks are served from 5 PM; the lecture starts at 6 PM. | Labels: | Last update November, 1999 |
| Membership: | Please apply for membership by contacting the secretariat. Membership dues: Fl 30,- | | |
| Accounts: | VSB Bank: 88 65 82 733 (PGK, Den Haag) | Postbank: 4074482 (PGK, Den Haag) | |

MARCH NEWSLETTER

NEW BOARD

At the annual meeting on February 16th the new PGK board was installed. The leaving members of the old board, Hans Klasen, Mieke Kusters and Jurry van Doorn, are greatly thanked for the excellent job they did the past two years for PGK. The members of the new board, Fokke Rispen (president), Wouter Hazebelt (vice-president), Mat de Jong (treasurer), Frank van den Belt (secretary) and Mark Geluk (excursion secretary) will continue the work and do their best to keep the PGK a successful Circle of the KNGMG. Please direct any future mail or email to the new secretariat. For financial matters you can contact the treasurer.

MARCH 15TH:

This month's PGK lecture is given by **Dr. M.E. Donselaar** from TU Delft.

INTEGRATED MODELLING OF LABYRINTH-TYPE FLUVIAL RESERVOIRS: EXAMPLE FROM THE HUESCA PROJECT

M.E. Donselaar

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The reservoir architecture of low net-to-gross fluvial reservoirs (so-called labyrinth-type architecture) is difficult to predict. They are often ranked as marginal reservoirs, characterized by loosely and randomly stacked fluvial channel sandstone bodies, with a low lateral continuity and connectivity. Reliable, extensive correlation levels are usually lacking. Well-spacing (in the order of 500-1000 m) may exceed the widths of the individual channel deposits. Even if a sandstone body is perforated by two or more wells, information about the inter-well area is missing. Sedimentological models alone, and the combination of these models with wireline logs and conventional surface seismic surveys are insufficient to characterise and often even locate these smaller reservoirs that contain a large part of the undeveloped oil and gas reserves. Labyrinth-type fluvial reservoirs are a common feature in the North Sea and Norwegian Sea Basins. Examples are the Westphalian-B (Carboniferous, offshore The Netherlands and UKCS), Skagerrak Formation (Triassic, North Sea Central Graben), Ness Formation (Jurassic, offshore Norway), and the upper part of the Delfland Subgroup (Cretaceous, West Netherlands Basin).

Advanced techniques to characterise and image these accumulations, such as cross-borehole measurements, deep-reading electro-magnetics, and high resolution surface seismic have been used in isolation to improve resolution to some 5 m. However, for hydrocarbon reservoirs it is usually not possible to verify this improvement and resolve inconsistencies between the results of different techniques, due to the lack of reservoir data with an even higher resolution such as core data over the entire field.

The Huesca Project aims to build a high-resolution sub-surface image of this type of marginal reservoirs based on the integration of outcrop-derived sedimentological data with conventional and advanced reservoir imaging data. The outcrop area is in the Ebro Basin (Spain) and comprises the Huesca Fluvial Fan System of Miocene age. The sandstone stacking is labyrinth-type: the fluvial sandstones have a low connectivity and float in a mudstone matrix. Low-sinuosity channel-fills and terminal lobes are the dominant fluvial genetic types. The 3-D sedimentary architecture was established on the basis of correlated sedimentological logs and photo panels of the cliff-face outcrops. Two shallow, 200-m-deep wells were drilled (Piracés-1 and Piracés-2) in the plateau on top of the cliff faces. Piracés-1 was completely cored (92% recovery) and a comprehensive logging program was completed in both wells, including spectral gamma-ray, neutron, density, formation micro-resistivity imager Tool (FMI*) for detailed sedimentological information, high-resolution azimuthal latero-logging sonde (HALS) for directional conductivity, electro-magnetic propagation tool (EPT) for high-resolution electro-magnetic attenuation and dielectric data, dipole sonic shear imager tool (DSI) for shear wave velocities, elemental capture composition sonde (ECS). All logs gave high-quality data, and the EPT in combination with density and neutron logs indicated an air-water contact at 126 m depth.

An equally comprehensive vertical seismic profiling (VSP) program was carried out in Piracés-1 with a station interval of 2 m, using the three-component seismic acquisition (SAT) tool, compressional and shear vibrators, and an air-gun placed in a water basin. Zero-offset and walk-away surveys were executed with an off-set of up to 50 m. Simultaneously, surface seismic lines between the wells were recorded with 3-C geophones. In addition, two common mid-point (CMP) lines with a length of approximately 140 m were recorded with horizontal geophones to measure the cross-line horizontal component from a cross-line horizontal vibrator (SH). Shear waves with a low (800 m/s) velocity could be distinguished, which will be essential for high-resolution imaging.

The campaign was successfully concluded with a surface transient electro-magnetic (NanoTEM) survey over an area of about 150 by 150 m around the wells. The NanoTEM signals give information down to 60 m with a vertical resolution of 2-3 m.

The data analysis and model building comprise: (a) Matching core, log and seismic surveys, and verification of the results with the outcrop data, (b) Evaluating novel subsurface imaging techniques such as NanoTEM tomography, and VSP with a shear vibrator, (c) Testing geo-statistical methods based on the geological data of the outcrop with the high-resolution information provided by borehole imaging logs and cores, and (d) Fine-tuning of the 3-D deterministic sedimentary architecture model on the basis of the analysed wireline log, seismic and NanoTEM data.

First results indicate that: (a) Dynamic-processed FMI logs serve to define the genetic type of fluvial sediment body and the provide data for channel trends, (b) NanoTEM cross-sections constrained by resistivity logs and surface seismics accurately images the shape and position of individual fluvial sediment bodies, (c) VSP and shear-wave seismic can be used to further constrain the outcrop sedimentary architecture model.

* FMI, HALS, EPT, DSI, ECS, SAT: Trade marks of Schlumberger Wireline Services

FORTHCOMING PGK EVENTS

April 19th: Lecture: Modelling the evolution of hydrocarbon systems in the West Netherlands Basin by Ronald van Balen.

OTHER EVENTS

Sedimentologische Kring **Lezingenmiddag**, Friday 17 March 2000, University of Utrecht, Faculty of Earth Sciences, Budapestlaan 4, Utrecht.

Symposium '**Management through Modelling**', Mijnbouwkundige Vereniging TU Delft.
Monday 22 May 2000, <http://www.mv.tudelft.nl/halflustrum2000/symposiumtabel.htm>.

MEMBERSHIP DUES 2000

All PGK members have received an acceptgiro for payment of their 2000 membership in January 2000. Those members that are still one or two years behind are requested to pay these outstanding dues to either VSB Bank account 88 65 82 733 or Postbank account 4074482 (PGK Den Haag; Dfl. 30,- for each year). Please note that the usual payment reminder/confirmation on the envelope label has been omitted this month; next month's payment information will be correct.

MEMBER NEWS

We have received **applications for membership** from **Mr. S. Whyte** (Clyde Petroleum BV) and **Mr. E. Simmelink** and **Mr. B. Orlic** (NITG-TNO). If no objections are received by the end of the next meeting they will be automatically elected members of the society.

PGK EXCURSIONS

PGK organizes two events this year; a one-day excursion around The Hague on May 21 and a 3-day excursion in the weekend of September 15-18. The September excursion will visit either the Carboniferous in NE France or the UK. Details will follow in the coming months. Register now for the one-day excursion. Although the programme has not been decided in detail yet, the excursion will show a combination of geology, archeology and petroleum geology. The excursion will be with private cars; in this way, the costs will be kept low. We therefore kindly ask you to indicate whether you would be prepared to be one of the drivers.

Send your registration before April 1st to:

PGK Excursion Secretary, Mark Geluk, c/o NITG-TNO, Postbus 80015, 3508 TA Utrecht, or register via e-mail (preferred) to m.geluk@nitg.tno.nl

Registration for the PGK one-day excursion on May 21

Name Address

Postal code City

Phone..... E-mail

Is willing to drive with his/her car
yes/no Number of seats

Signature

The following companies are warmly thanked for sponsoring the PGK in 1999:

**Amoco Netherlands B.V.- Argo Geological Consultants -
Chevron USA Inc., The Netherlands Branch – Clyde Petroleum Exploratie B.V. –
Core Laboratories Aberdeen – DSM Energie – Energie Beheer Nederland B.V. -
Elf Petroland B.V. - Enres International – Fina Nederland B.V. – Fugro Inpark B.V. -
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The following companies have already allocated sponsorship for 2000:

Hogeschool Rotterdam, sectie aardrijkskunde -TransCanada Int. (Netherlands) B.V.

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