



PGK

Petroleum Geologische Kring

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Venue:	PGK's monthly meetings are held at the KIVI building, Prinsessegracht 23, Den Haag. Drinks are served from 17:00 hrs; the lecture starts at 18:00hrs.	www.pgknet.nl twitter @PGKring	
Membership:	Apply for membership through the PGK website. The annual fee is €15.-		
Accounts:	ABN/AMRO Bank: 88.65.82.733 (PGK, Den Haag)		

APRIL 2013 NEWSLETTER

17TH OF APRIL 2013: PGK MEETING

The next PGK meeting will be on Wednesday, April 17th, 2012 at the KIVI building, Prinsessegracht 23, Den Haag.

17:00-18:00 hrs: Social hour

18:00--19:00 hrs: Lecture by: Hans de Waal (State Supervision of Mines)

Groningen induced seismicity

Abstract on separate page

19TH OF APRIL 2013 – PGK DAY TRIP

Coal from the Netherlands: a day trip to discover history and geology of the coal district in Limburg. More information and registration on www.pgknet.nl.

15TH OF MAY 2013: PGK MEETING AND KNGMG AGM

16:00-17:00 hrs: KNGMG Annual General Meeting

17:00-18:00 hrs: Social hour

18:00-19:00 hrs: Lecture by Dr. Anco Lankreijer on Geology and Wine – The Taste of the Earth (in preparation of the Languedoc excursion)

JUNE 14TH – 17TH: GEO-GASTRONOMIC FIELD TRIP TO THE LANGUEDOC

Guide: Michel Lopez (University of Montpellier). Registration will open soon, for details see website.

JUNE 19TH: ANNUAL BBQ AND MINI-SYMPOSIUM ON ARCTIC DRILLING

Together with SPE, location to be decided, registration required. Speakers from Shell and Greenpeace.



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NEW MEMBERS

Applications for membership have been received from Rob Biemans (NAM), Katarina Borowski (Chevron), Manuel Bussmann (UvU), Laura van Leeuwen (PanTerra), Chris Maaijwee (PanTerra), Amy Nicholson (Shell), Inja Thijssen (VU), Els Ufkes (VU), Paul van der Vegt (PanTerra), Age Vellinga (Utrecht), Ilse de Vent (SodM), Manon Westetr (independent). If no objections are received prior to or during the next meeting, they will be admitted as member of our society.

WEBSITE

The link to our website is www.pgknet.nl. Check there for the latest news on meetings, events, excursions, jobs, membership. If you come across interesting websites that may be of use to other members of the PGK, please send the URL to the web master (gijs.straathof@sgs.com), who will share them on the PGK website.

TWITTER

We are now on Twitter @PGKring. The account shall be used to announce events, send reminders for events and occasionally to retweet interesting items. So follow us on twitter!

LINKED-IN

We also have a group on linked-in (called PGK), that our members may join. Any member of the group is free to list subjects there. Requests to the secretary for linked-in contacts will be ignored, as the secretary function does not have a linked-in account.

Thanks to our sponsors:

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**PROGRAM PGK MEETING WEDNESDAY APRIL 17TH, 2013**

Address: KIVI Building, Prinsessegracht 23, Den Haag

Social hour: 17:00 - 18:00

Lecture: 18:00 - 19:00 : **Groningen Induced Seismicity**

Hans de Waal¹ & Annemarie Muntendam-Bos (State Supervision of Mines; The Hague)

Abstract

On January 22 2013 State Supervision of Mines (SSM) advised the Minister of Economic Affairs to reduce production of gas from the Groningen field as fast and as much as realistically possible. The advice is based on an investigation by SSM into the higher than predicted frequency of earthquakes with a magnitude equal to or above 3.0. The occurrence of the highest magnitude earthquake thus far, near Huizinge in August 2012, with a moment magnitude of 3.6 gave further impetus.

SSM limited the analysis to earthquake data from the Groningen field only, focussing on the seismic behaviour of the field, the relation with production(rate) and the relation between the number of events and their magnitude. The main conclusions leading to the advise are that 1) the annual number of events in the Groningen field and the seismic energy released, increase with time and with depletion; 2) little can be said about the maximum possible magnitude in Groningen other than that it can have any value above 3.6; 3) the expectation value for the probability of higher magnitude earthquakes is significantly higher than previously recognised; 4) during the last 10 years the number of tremors has, in first order, been proportional with production with a delay of about one year and 5) the expectation value for the probability of higher magnitude earthquakes can be decreased by decreasing the annual gas production.

SSM's main mission is to ensure that mining activities and the transport of natural gas are performed in a socially responsible manner. A low probability for an earthquake with a 3.9 magnitude is considered an acceptable upper limit for mining induced seismicity, confirmed by the Dutch Council of State in a number of legal cases. This no longer applies to Groningen and hence the recent advice to reduce production.

Reservoir compaction is the driving force behind gas production induced seismicity. Compaction in the Groningen field is non-linear with production and pressure drop. SSM therefore investigates the hypothesis that the mechanism behind the non-linear compaction also drives the seismicity. One mechanism postulated earlier is rate-type behaviour of the reservoir rock which relates the observed non-linearity to loading rate dependent strain-delay. Assuming that seismicity can release the accumulated delayed strain (the "missing" strain or "missing" compaction) on rock interfaces, a relation can be derived between the annular number of earthquakes, cumulative production and production rate. It describes the observed seismicity within the intrinsic statistical uncertainty. It also explains why no seismicity was observed prior to 1990.

State Supervision of Mines (SSM) oversees the compliance with statutory regulations applicable to mineral exploration, extraction, storage and transport of minerals, focusing on the aspects of health, safety, the environment, effective extraction and soil movements

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