

Exploration and comparison of geothermal areas in Indonesia by fluid-rock geochemistry

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August 7, 2016



Cooperating companies & universities



IF Technology



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Outline

- GEOCAP project
- Aim of this work
- Sampling areas and analytical approach
- Fluids and rocks: first results
- Outlook and perspective joint work Netherlands-Indonesia

National Geothermal Development Plan

Issued by Bappenas 11 November 2011:

- Ambitious plans to upscale activities in Geothermal Energy
- Substantial increase in Geothermal Energy
- Assessment of the need for trained personnel
 - Scientific staff in Universities
 - National and local Government staff
 - Management and technical staff in Companies
- Request from BAPPENAS to Netherlands for support in Capacity Building
- GEOCAP as a 6 million euro contribution to support geothermal capacity building

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GEOCAP: geothermal capacity building program

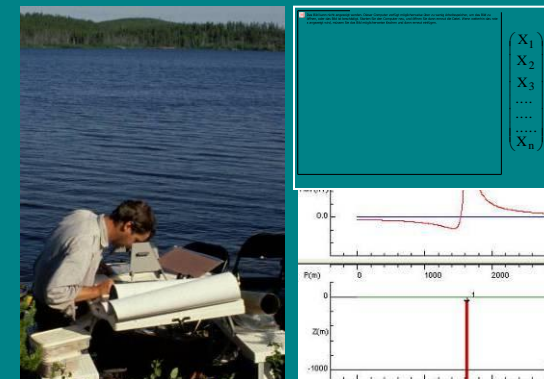
Objective of GEOCAP:

increase the capacity of Indonesian Ministries, Local Government, Agencies, Public and Private Companies, and Knowledge Institutions in developing, exploring and utilization of geothermal energy resources and to assess and monitor its impact on the economy and the environment

- Training Capacity – 10 work packages
- Research Capacity – 8 work packages

GEOCAP overview

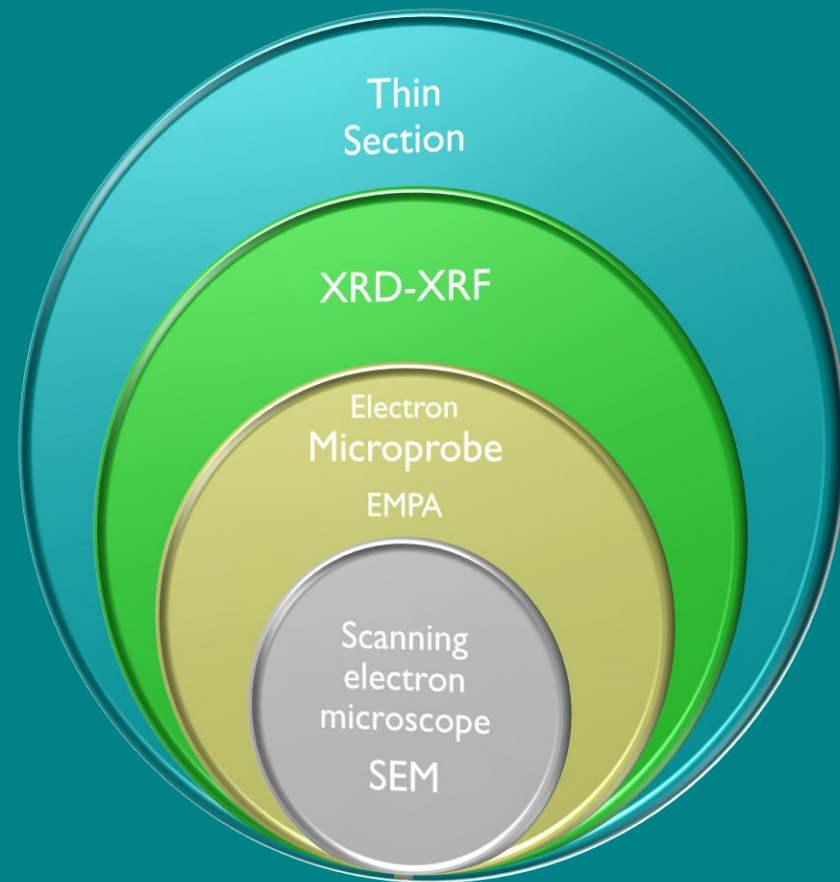
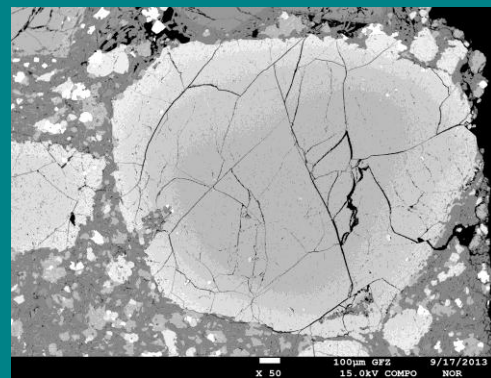
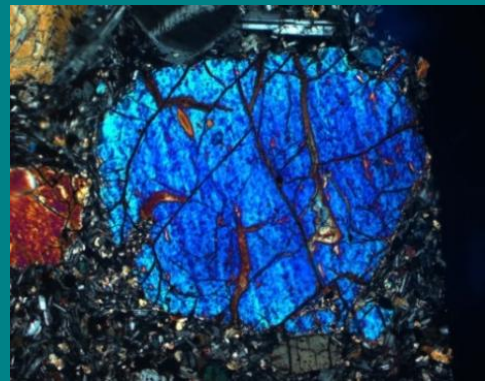
Education & training	Research	Others
1.01 - Geothermal exploration knowledge and skills deepening	2.01 – Techno-economic risk assessment	3.0 – Use of low-medium enthalpy resources
1.02 - GGG regional and site exploration workflows	2.02 – Geomechanics and reservoir modeling	4.0 – Geothermal database integration
1.03 – Drilling skills	2.03 – Advanced geothermal drilling (detailed drilling data logging and analysis)	5.0 – Management and coordination
1.04 – Geothermal exploitation knowledge and skills	2.04 – Improvement of exploration concepts	
1.05 – Operation and maintenance skills for geothermal power plants	2.05 – Hydro-fracturing and acidizing	
1.06 – Master class course/training for high level decision makers for geothermal projects	2.06 – Geothermal power plant efficiency systems development	
1.07 – Project decision and risk management and financing	2.07 – Geothermal geodynamics (e.g., geothermal 2050)	
1.08 – Environmental assessment (EIA, SEA, PGIS)	2.08 – Rules, regulations, policy and governance	
1.09 – Development of integrated training materials (compilation)		
1.10 – Dissemination of project outcomes		



Aim of this work

- Compile an overview of the geochemical data – rock properties from important geothermal fields in Indonesia.
- Application of geochemistry and petrology to investigate fluids and rocks: new information will be gained from several sites, i.e. West Java, Central Sumatra and North Sulawesi.
- Combine research activities along with capacity building in the field. Involvement of academics, industry partners and government institutions.
- The approach will deliver a best practice guide on how to explore fields with different geological backgrounds.
- Benefit for the operators and users: quick results allow to plan better geophysical campaigns.

Analytical approach



Sampling sites

Tangunban Perahu, West Java

Wayang Windu, West Java

Plan:

Central Sumatra Basin

Lahendong, North Sulawesi



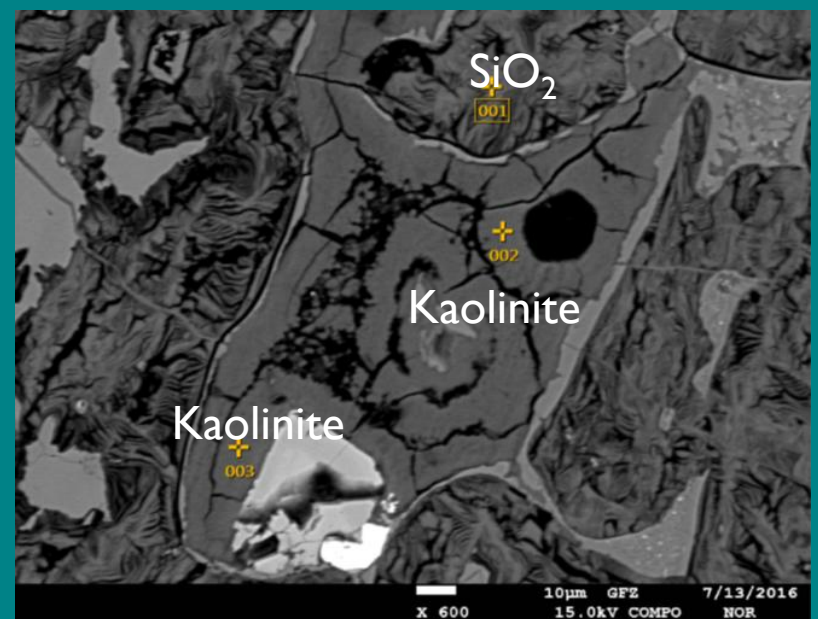
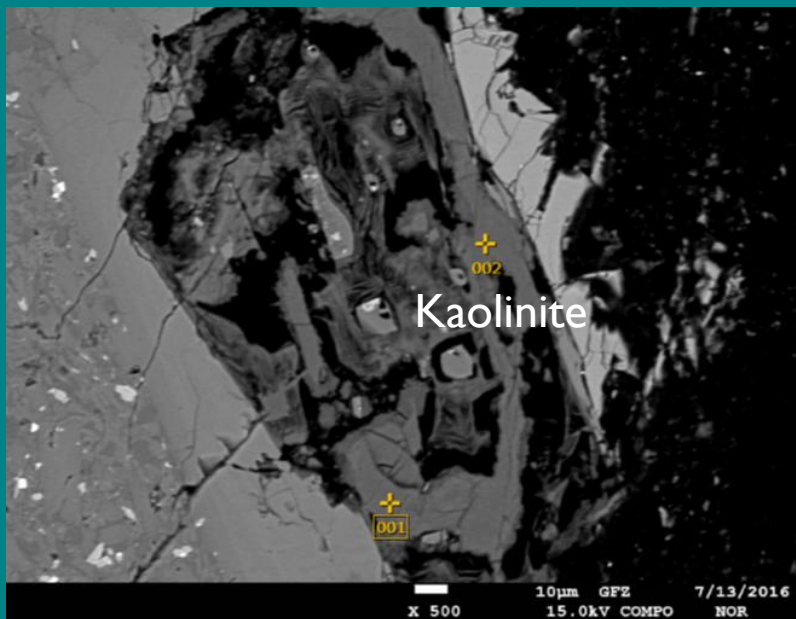
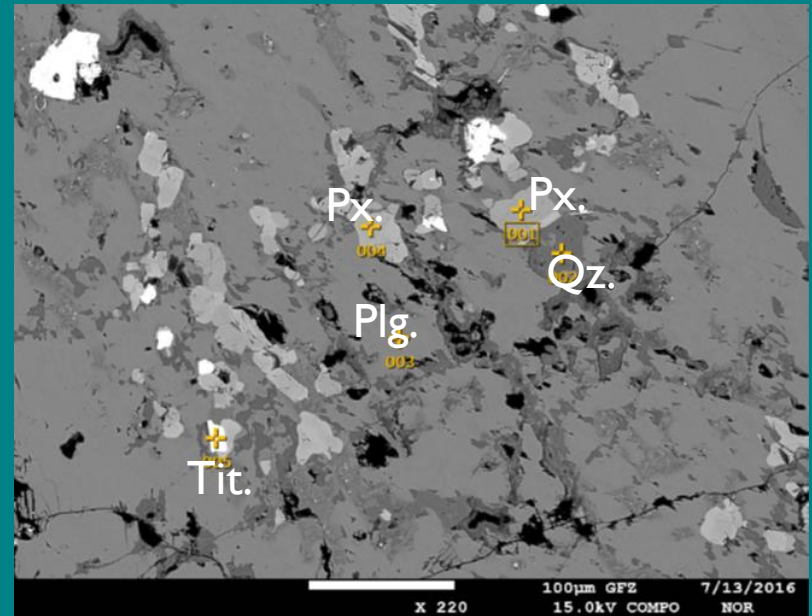
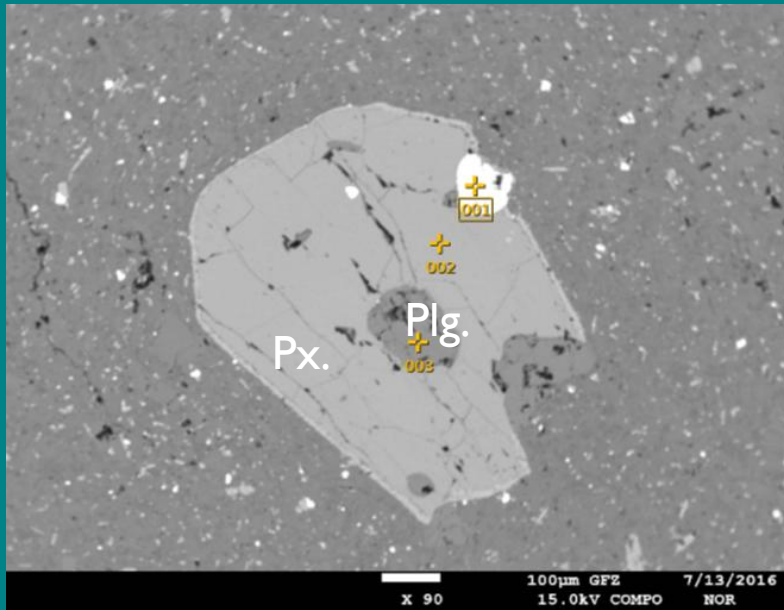
First results on rock samples

Wayang Windu – Kawah Wayang

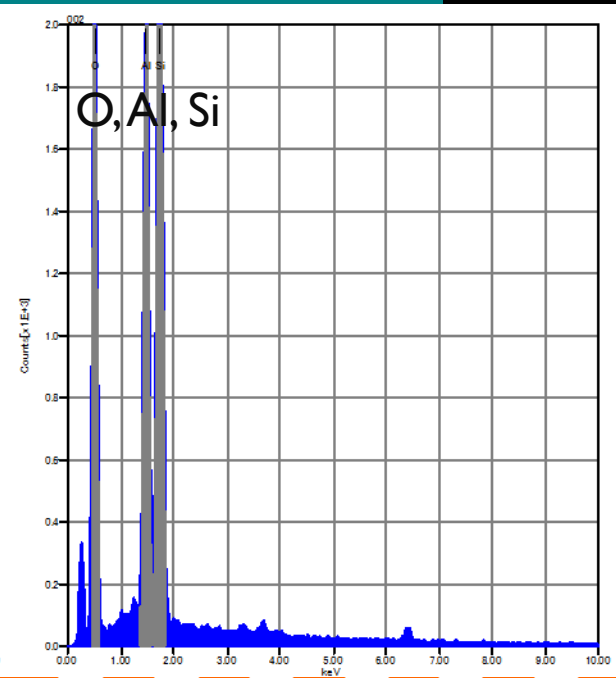
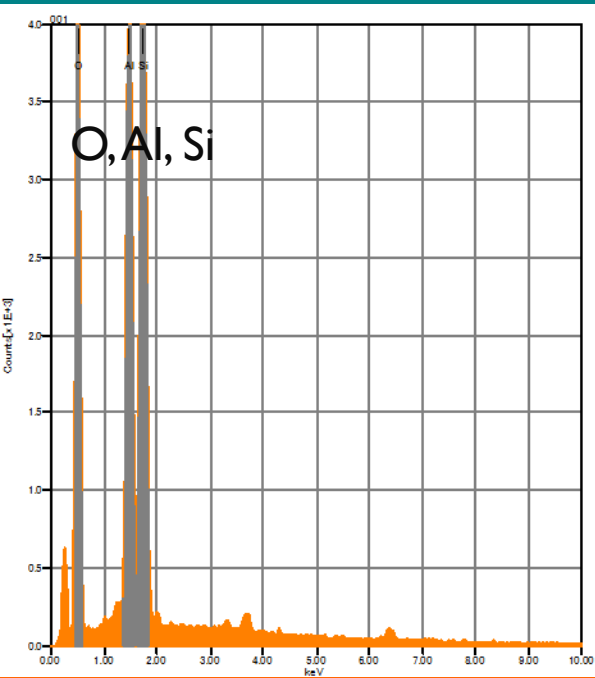
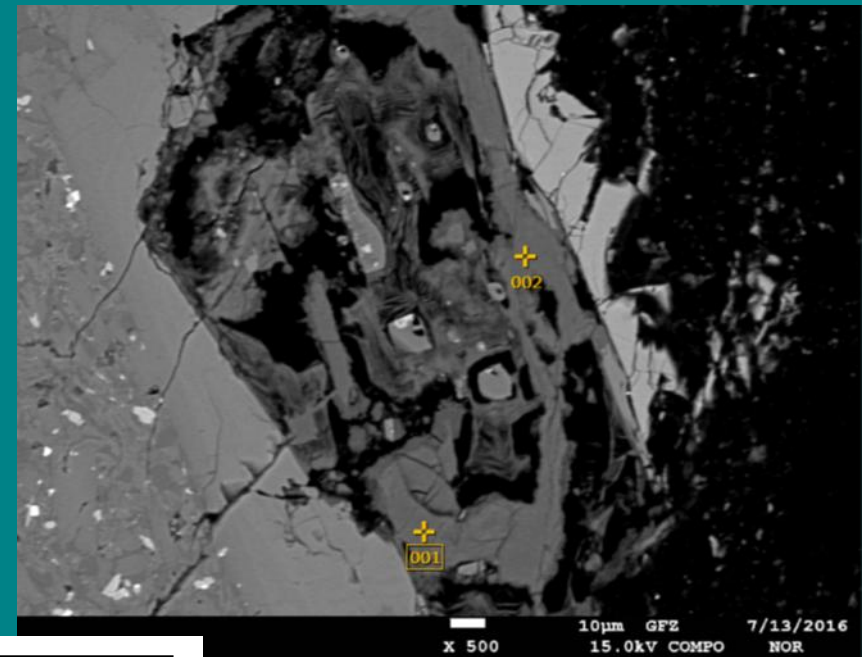
Volcanic rocks with glass matrix and macro-crystals.

Occurrence of plagioclase, quartz and traces of hydrothermal alteration.

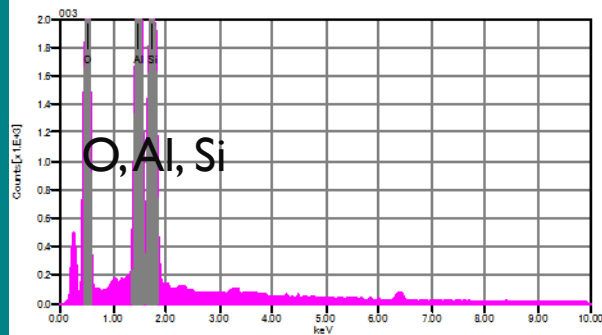
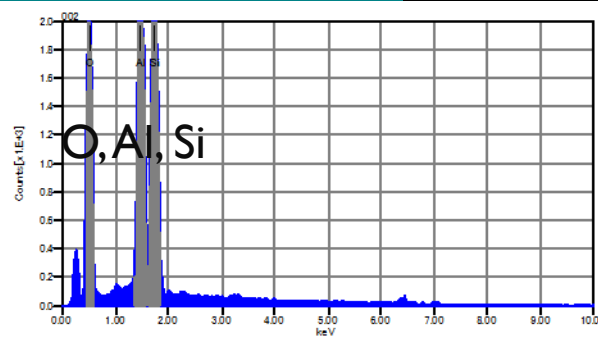
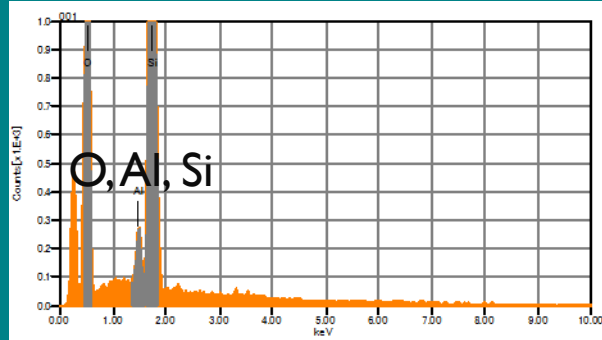




EBS spectra: Kaolinite



EBS spectra: Glass matrix Kaolinite



First results on fluid samples Wayang Windu and Tangunban Perahu



Tangunban Perahu
Domas crater T 88°C
pH 1



Wayang Windu
Kawah Wayang T 68°C
pH 1.8

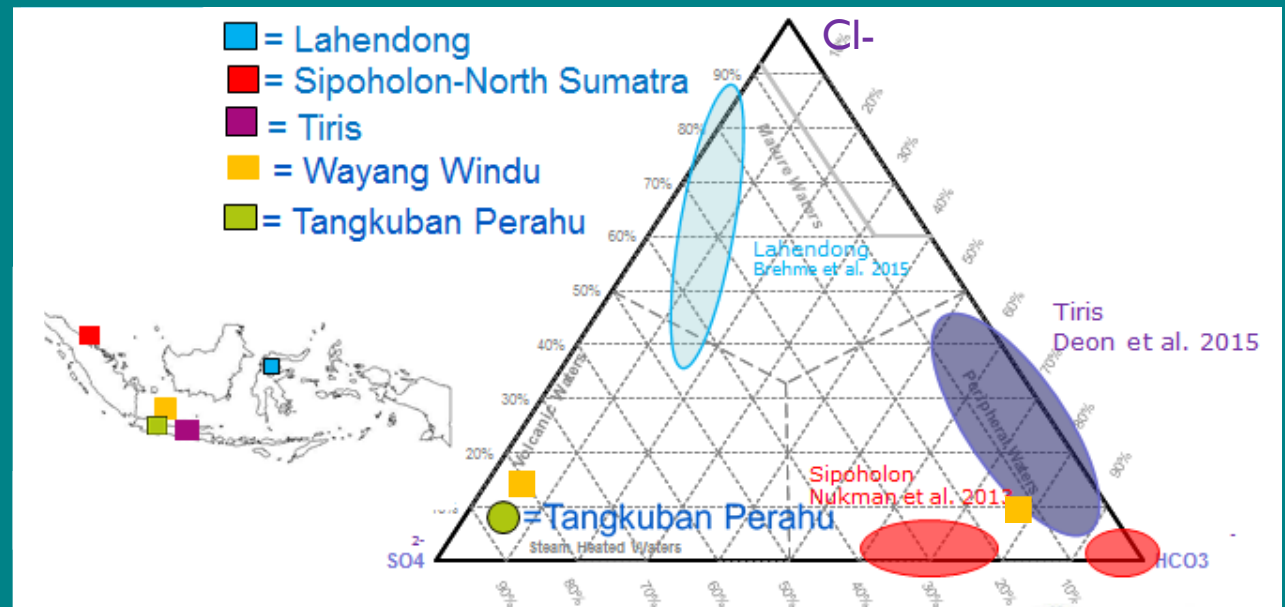
Water geochemistry

Considerable amount of SO_4^{2-} :

Domas crater: high sulfate content – no bicarbonate HCO_3^-

Wayang Windu: up to 1700 ppm SO_4^{2-} sample from the crater. Due to the vicinity to the heat source

Cibolang (VW): only sampled spring with bicarbonate content



Outlook and perspectives

- Geomechanical experiments at Delft University of Technology (TUD) in joint cooperation with ITB
- Extend the fieldwork soon to North Sulawesi and Central Sumatra.
- Permission from field owner-administrator to be organized. Goal is to cooperate and work jointly with the Indonesian partners.
- Capacity building activities within the research framework with the involvement of academics, industry and governmental institution.
- Best practice guide on how to explore fields with different geological backgrounds

Acknowledgements

Ministry of Foreign Affairs of the Netherlands

Star Energy Wayang Windu

Pak Sanusi Satar, Indonesian GEOCAP coordinator

Famelia Nurlaela (ITB Bandung Indonesia)

Dicky A. Zaky (ITB Bandung Indonesia)

Nurita Putri (ITB Bandung Indonesia)

Francesco Pizzocolo (TNO, Utrecht the Netherlands)

Peter Fokker (TNO, Utrecht the Netherlands)

Oona Appelt (GFZ Potsdam, Germany)

Iris Piper (Technical University of Berlin, Germany)



Thank you for your kind attention
Terima kasih atas perhatian Anda

