

Matzen Field Redevelopment, Pitfalls and Ways to Improve*

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Abstract

The giant Matzen Field is located 30 km northeast of Vienna, Austria. The multi-pool oil and gas field was discovered in 1949 and is the largest in the Vienna Basin. The structure is a shallow anticline with an axis in the ENE-WSW direction and an extension of 12x5 km. It is bounded to the North and West by a system of normal faults and delimited to the South and East by a shale-out in the basinward direction. The field consists of multiple clastic reservoirs; two of them, the 8.TH and 9.TH are subject of an ongoing redevelopment program. Both reservoirs are of Middle Miocene age, were deposited in a shallow marine environment and are characterized by complex reservoir architecture.

In order to prepare a redevelopment after more than 60 years of production, various integrated G&G studies consisting of seismic, regional geology, sequence stratigraphy and core analysis (e.g.) were carried out and integrated in separate 3D geologic models that were repeatedly revised and enhanced. Results from reservoir simulation were used to further improve static models (and vice versa).

The findings of a recent six well drilling campaign with a tailored data acquisition and analysis program allowed an in-depth reality check of work carried out so far and the planning of follow-up G&G work. The aim of this approach was a holistic view of the two reservoirs with the purpose of identifying the best remaining drilling locations. The secondary objective was to build more precise static models implementing workflows agreed and accepted by all disciplines involved.

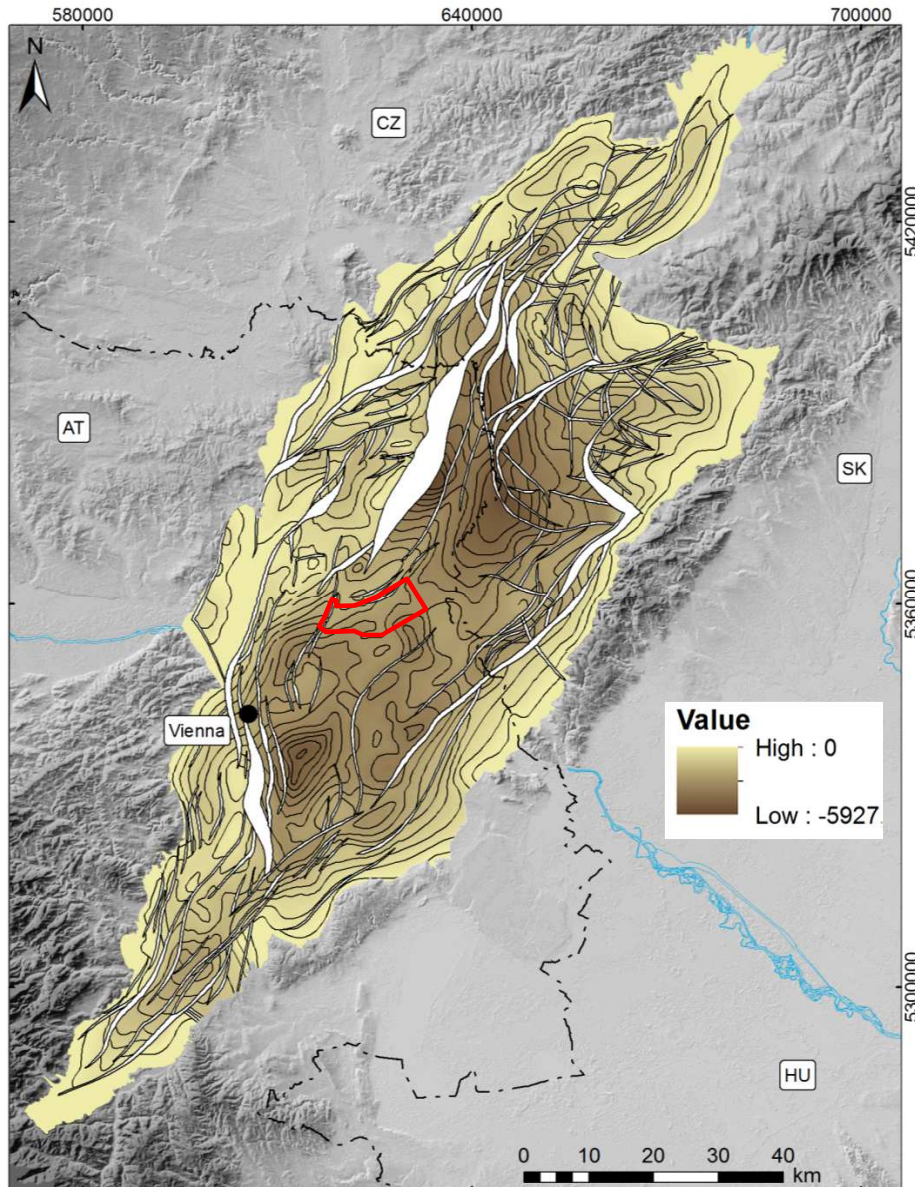
Extensive comparison of the models with newly acquired data resulted in an improved understanding of the reservoir and in the abandonment of 'established' knowledge. Examples of successfully applied working techniques range from a sequence stratigraphic interpretation system to depositional environment maps. Some analytical techniques applied did not produce good results; the geoscientific reasons for this were analyzed; the less successful approaches identified will be avoided in the future.

Structured and repeated reality checks were found to be crucial for the continuous improvement of the subsurface models. Workflows to be followed were developed; they led to a prioritization of work, allow faster updates of models and enable an optimized selection of future well locations.

Matzen Field Redevelopment, Pitfalls and Ways to Improve

Istanbul, 16th of September 2014

Regional Overview



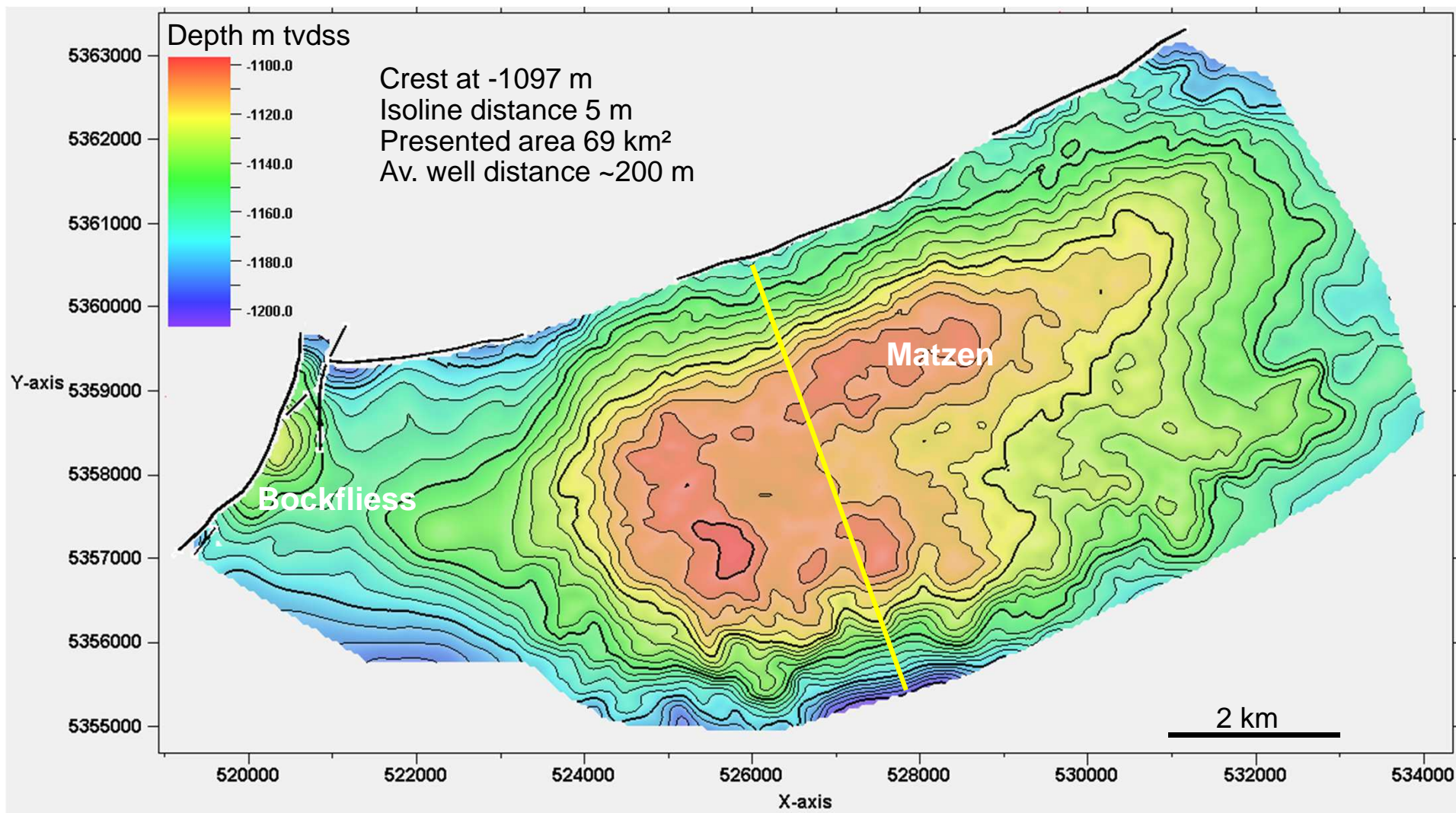
The Matzen Field is located in the central part of the Vienna Basin, a pull-apart basin between the Eastern Alps and the Western Carpathians.

The Matzen Field, a large multipool accumulation with 60+ years of production history is undergoing a major redevelopment. Initial hydrocarbons in place correspond to 289 MMboe of gas and 1,501 MMbbl of oil.

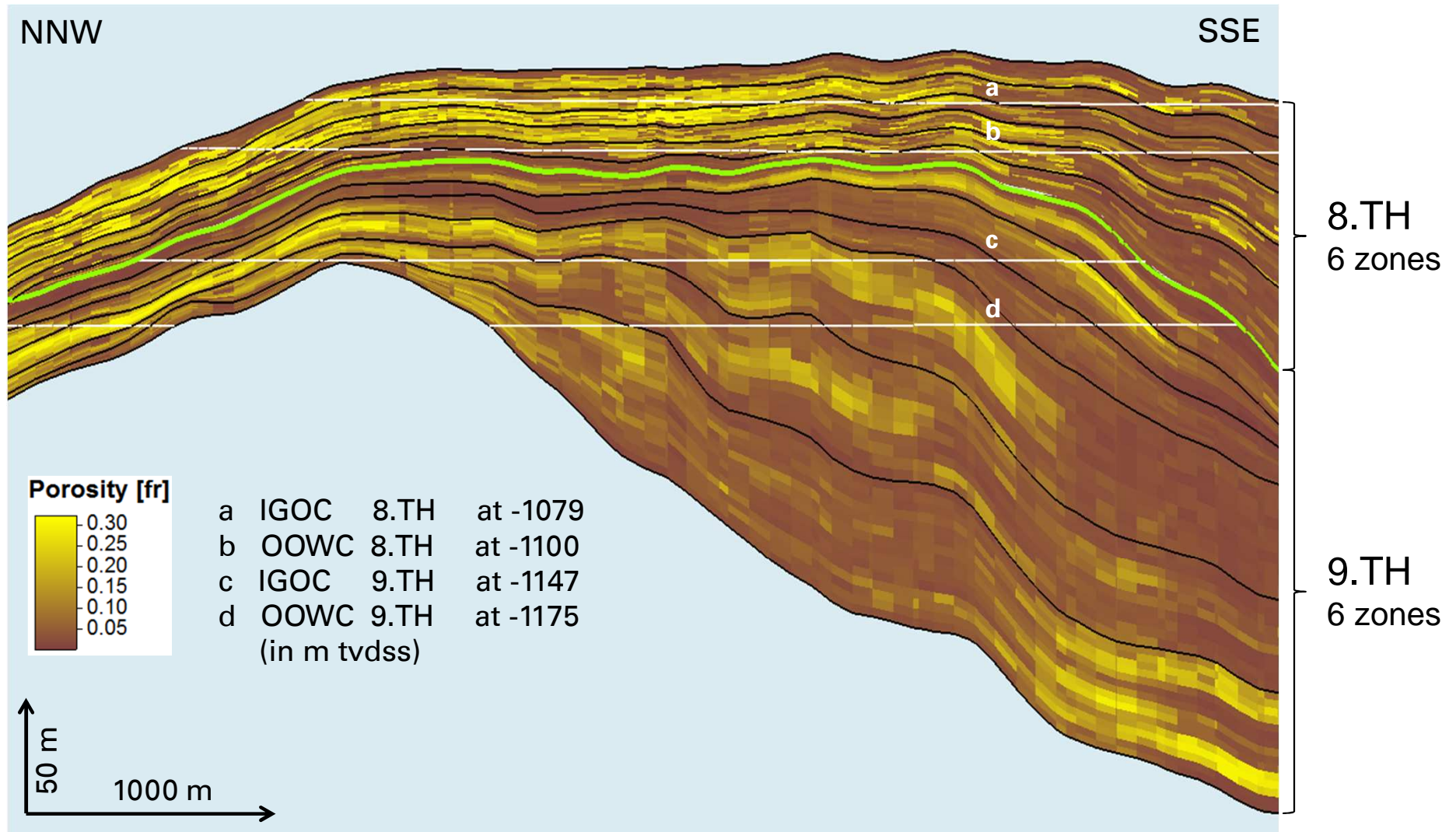
Substantial data from 1000+ wells, 3D seismic and production data have to be considered.

The clastic reservoirs are of Miocene age; focus of the presentation is on the Badenian 8. and 9.TH.

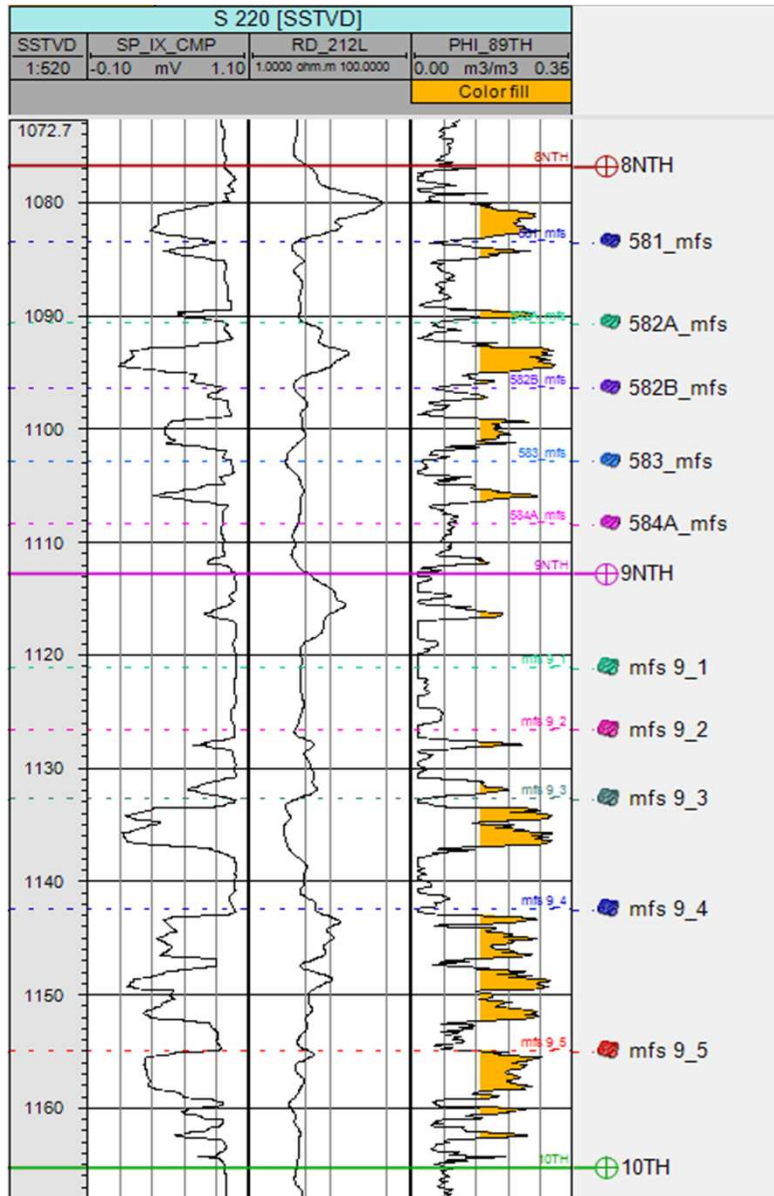
Depth Structure Map Top of 9.NTH



X-section through Porosity Models of the 8. and 9.TH



8./9.TH Layering and Petrophysical Interpretation



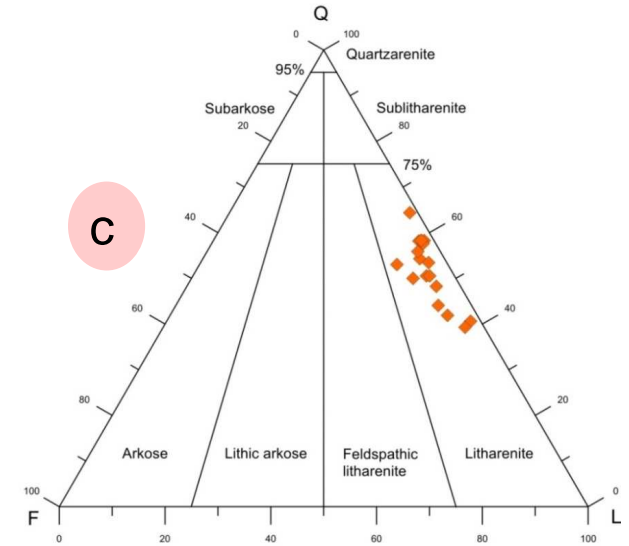
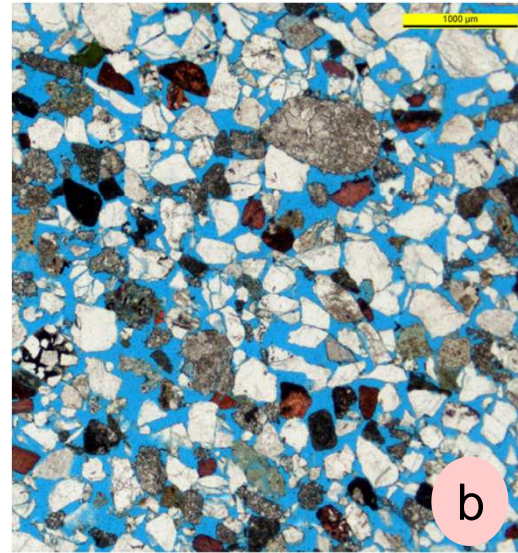
Example of a SP-based porosity interpretation; available for ~98% of the wells.

- Porosity interpretation via a complex, core calibrated transform.
- Does not see limestone and dolomite.

22 wells with modern log suites were analysed, six of them came with a recent drilling campaign.

- Detailed interpretation.
- Comparability ('modern/old') is a problem that is worked on.

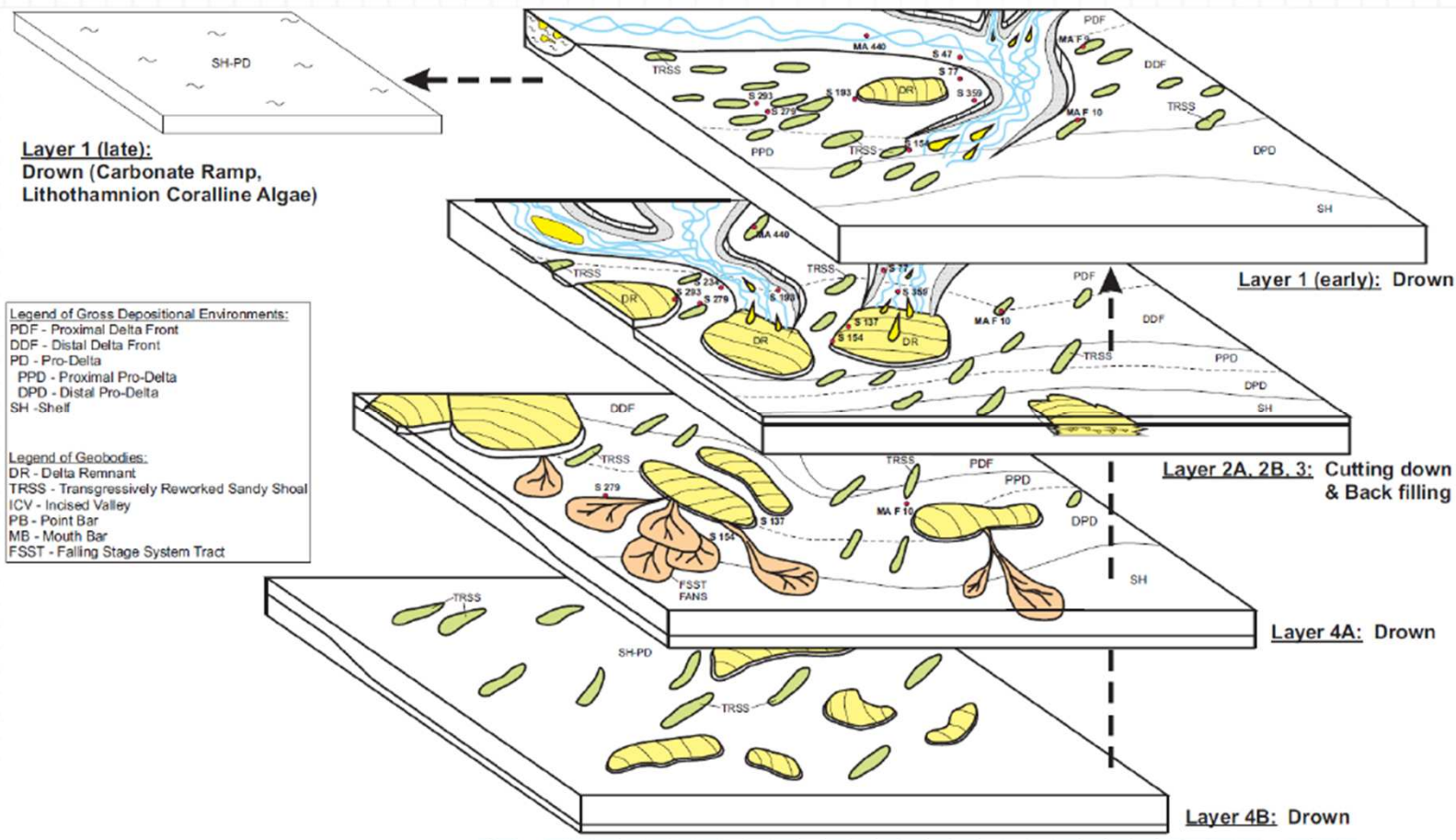
Sedimentology, e.g. 8.TH



- b) Medium grained litharenite with well connected interparticle porosity (32% por, 7950 md perm).
- c) The mineralogy of the various reservoir sandstones is characterized by high contents of quartz and detrital dolomite.

a) Slabbed modern core, UV light

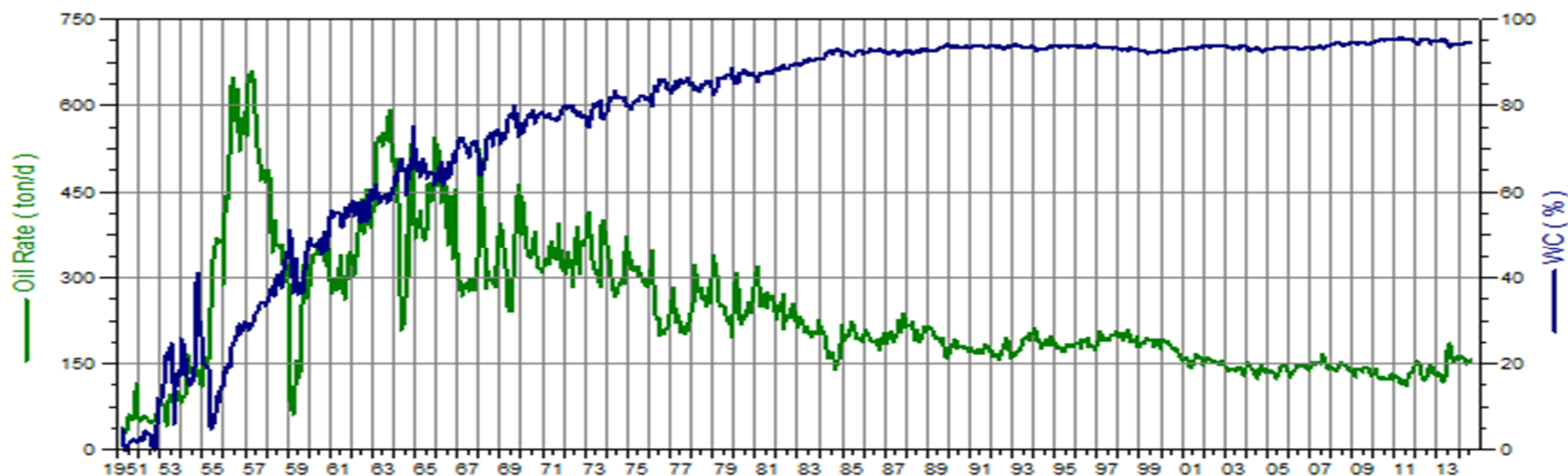
Depositional Facies Analysis, e.g. 8.TH



Shallow marine depositional environment, pro-delta to proximal delta front facies with local tidal distributary channel evidences. Illustration by HOT.

Production History, e.g. 9.TH

Start of production in 1951, start of water injection in 1968
98 producers and 10 injectors in February 2014



The graph shows one reservoir but is representative for the entire field; so far 553 MMbbl oil and 155 Mmboe of gas were produced.

Reservoir Overview and Modeling Efforts

Matzen Field					Models	
Age	Horizon	Gas	Oil	Storage	Static	Dyn
Pannonian	1, 2					
	3, 4				X	X
	5					
Sarmatian	1, 2					
	3, 4					
	5				X	X
	6					
	7					
	8					
	9					
	10					
Badenian 'Torton'	1					
	2, 3					
	4					
	5				X	X
	6				X	X
	7				x	x
	8				X	X
	9				X	X
	10				X	
	11				X	
	12				X	
	13				X	
	14, 15					
	16				X	X
Karpatian	Several				x	x

Aim end 2008 was

- To move work to (then) nowadays standards.
- To see what can be achieved by modeling.

Aim 2014 is

- to create 'fit for purpose models'
- and to merge them.

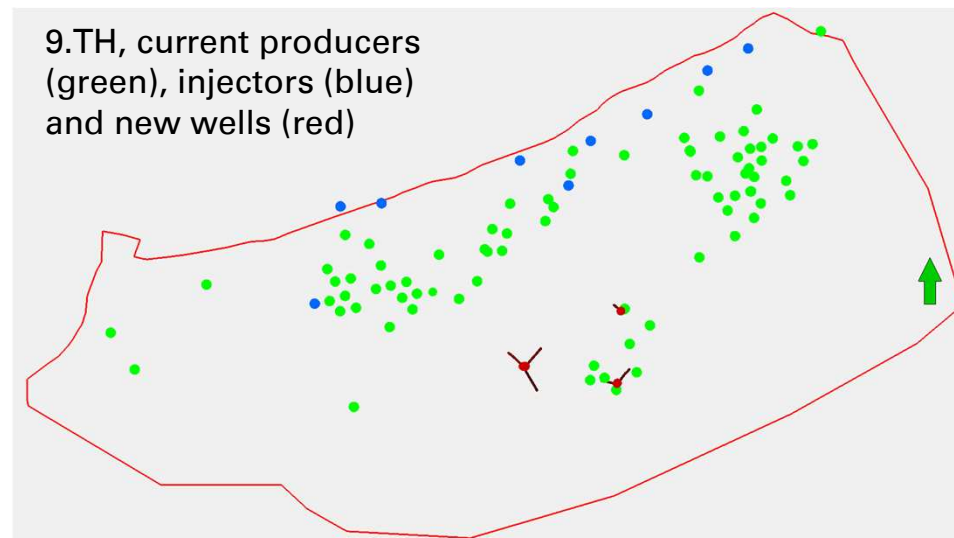
2 feasibility studies, 2 independent static models, updates, sector models, 2 independent simulations and streamline simulations

New Data and Reality Checks, a Selection ...

In 2013 six wells were drilled to re-develop the 8./9.TH and one targeting the 16.TH reservoir.

The acquired data were used to analyse strengths and weaknesses of the existing **static and dynamic** models.

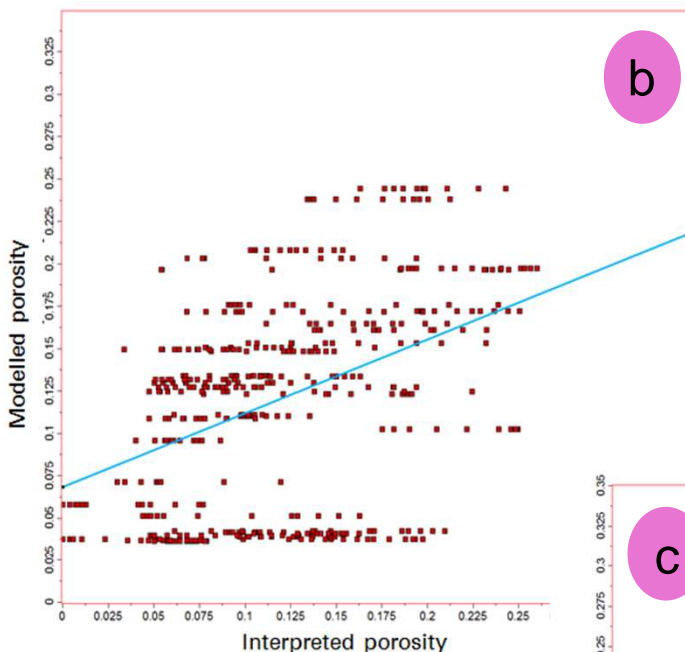
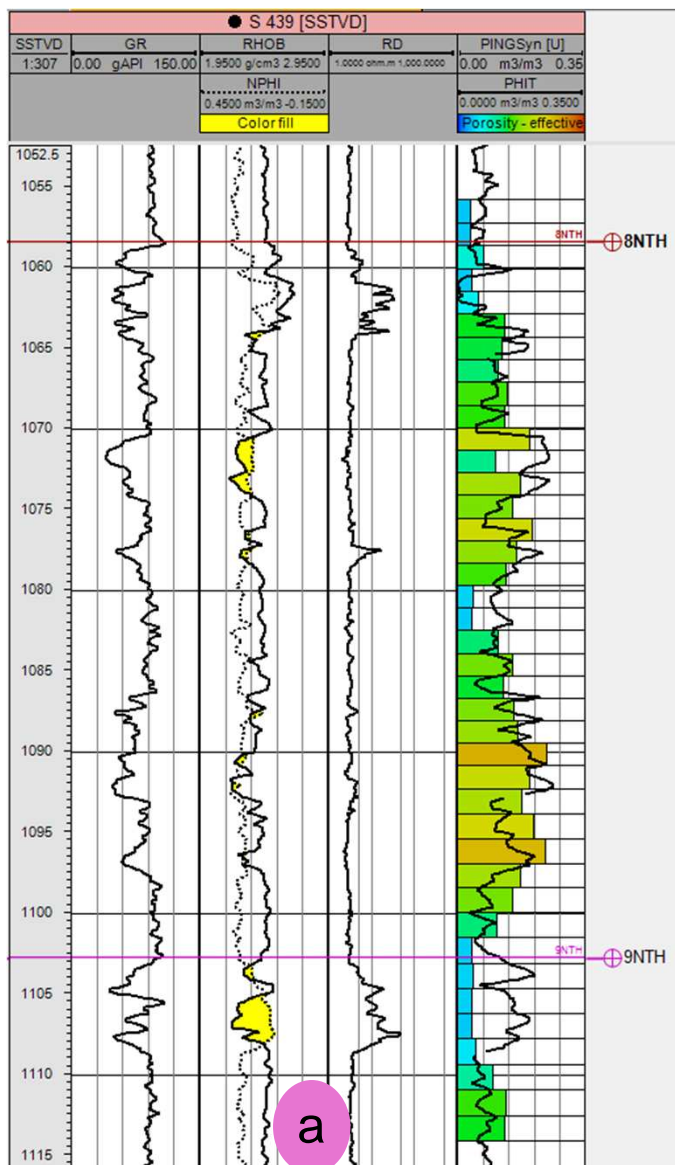
These checks were a view in the 'rear-mirror'.



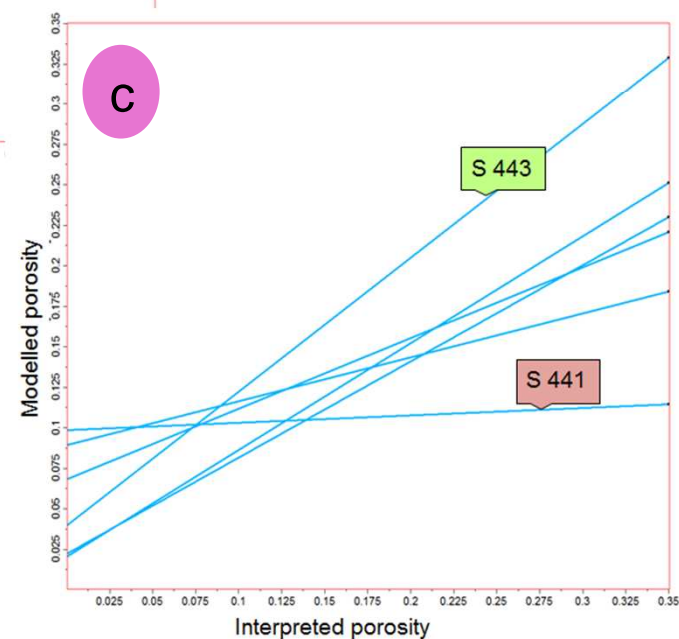
Structure	Top / base, internal structuration, layering.
Parameter	E.g. porosity; prediction versus well results, trends. Facies, permeability, Sw, simulation (not presented).
Methods	Adequate or misleading, reasons for pitfalls, assumptions, workflows and documentation.

Seven to eight wells will be drilled in 2014/15.

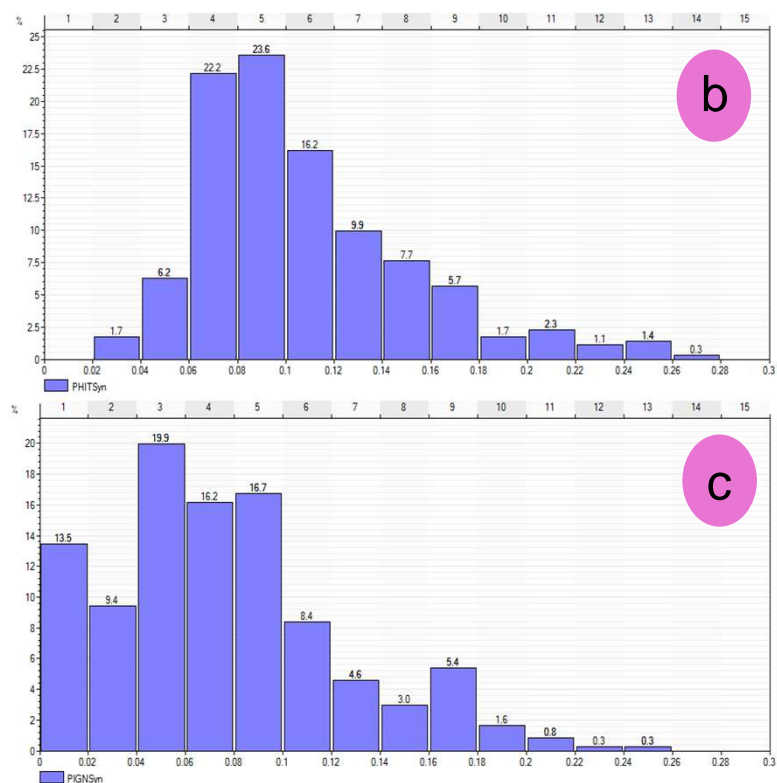
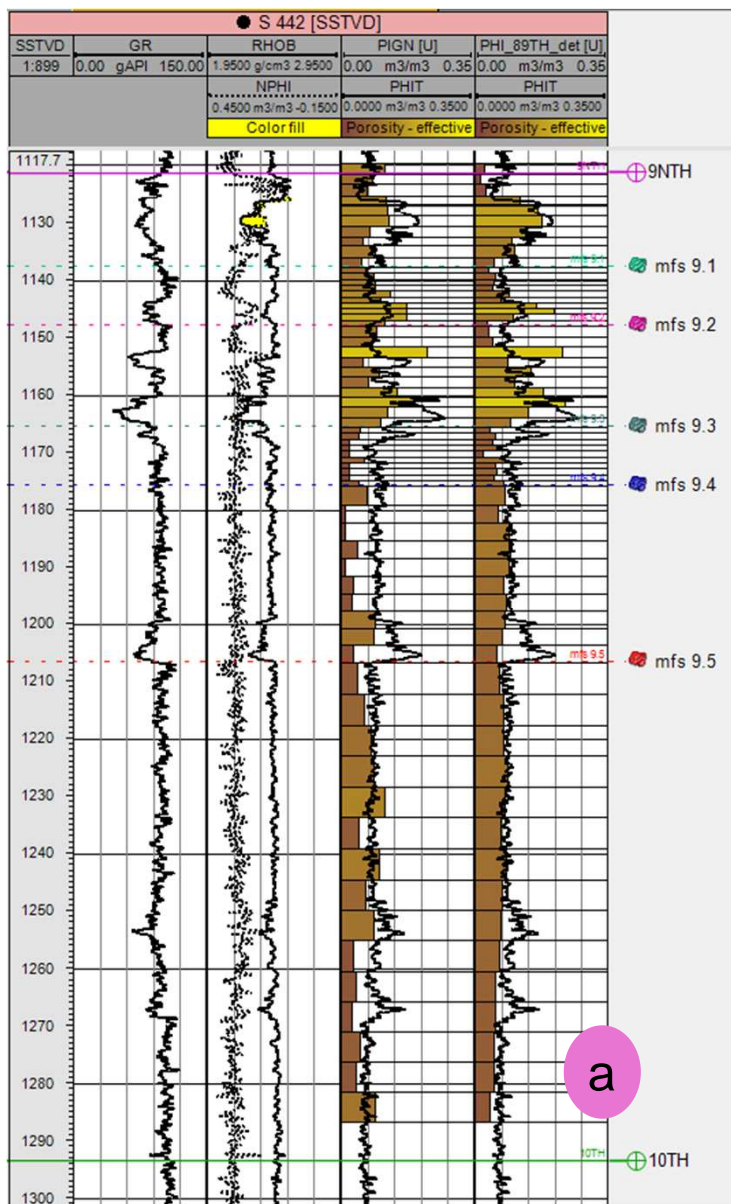
Reality Check, e.g. 8.TH



- New well, to the right interpreted vs modelled porosity.
- X-plot modelled vs interpreted porosity, regression line.
- Regression lines of all six new wells.


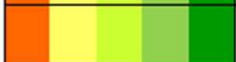

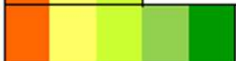
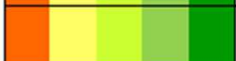


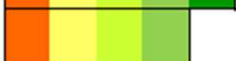
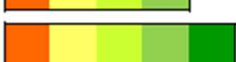
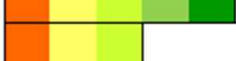
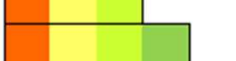
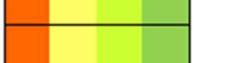
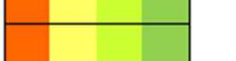

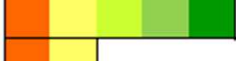
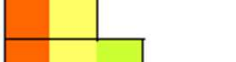


Reality Check, e.g. 9.TH



- New well, to the right interpreted porosity (black) vs porosity from two different models (colour).
- Porosity of six new wells upscaled according to the 9.TH model and synthesized for comparison.
- 9.TH model, porosity prediction of a.m. wells, selected/simulated model.

Conclusions (e.g. 9.TH); project managements view

Validation of data-base		Benefits from previous studies
Geophysics, interpretation		Resolution, shifts, use of SSIS
Attributes		Restricted use
Geology, re-correlation		Tops, seismic and prod. history in line
Petrophysical interpretation		SP-based porosity, modern log suites
Advanced petrophysics		Impact not finally judged
Sedimentology, facies etc. from cores		Gone as far as possible
Reservoir diagenesis		Reviewed, more to be done
Structure model		Consistent, layering improved
Facies model		Update necessary
Property models (por, perm, Sw)		Update necessary, specific aspects
Modeling algorithms		Results compared, not finally judged
Integration of applied RE and sim. results		Acceptable, ongoing
Documentation, reporting		Fully acceptable
Workflows, updateability		In progress
QC methodology		In progress



Quality range from unacceptable
to fully satisfying; based on
project definitions.

Mitigation, way forward ...

All models and all reservoirs:

Feedback, lessons learnt and a structured handover.

Matzen Framework Project:

Alignment of all mapped surfaces, faults and modern tops. Continuous efforts to keep them updated.

Project QC methods:

Development of agreed QC methods (forward/backward) for delivered static models; project together with services.

Building of workflows to enable fast model updates.

Organisational steps to enable continuity.

People involved (2009 to 14)

A. Ballauri	(G&G)	R. Möbius	(G&G, modeling)
Y. Boisseau	(Modeling advice)	Dr. J. Perez	(G&G, modeling)
M. Chiotoroiu	(Simulation)	Dr. R. Ramberger	(Petrophysics, HOT)
Dr. T. Clemens	(RE advice)	E. Rieser	(Geophysics)
Dr. C. Cubitt	(Sedimentology, HOT)	A. Rech	(Petrophysics)
Dr. R. Finsterwalder	(Coordination, G&G)	J. Rhoades	(Data management)
G. Gonzales Uribe	(G&G, modeling)	Dr. H. Rohler	(Petrophysics)
Dr. W. Gruber	(G&G, modeling, HOT)	D. Sanchez Mendoza	(Sedimentology)
M. Haake	(G&G, modeling)	T. Schröckenfuchs	(G&G, modeling)
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T. Kuffner	(Seq. strat., sedimentology)	J. Steckhan	(Petrophysics)
Dr. R. Lind	(Simulation, HOT)	Dr. D. Steineder	(Applied RE)
M. Lüftenegger	(Applied RE)	G. Thürschmid	(G&G, modeling, HOT)
K. Mantatzis	(Simulation)	P. Toth	(G&G, modeling)
T. Mikuz	(Petrophysics)		

Thank you for your attendance!

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