

Geothermal energy Your power – our performance

Exploration & Geosurvey



Geophysics

Processing

Interpretation
and Seismic Modelling

Hydrogeology

Monitoring

References



The exploitation of geothermal deposits for energetic use is a promising field of work. Already during exploration some economically decisive advantages can be gained. Precise planning, thorough surveying and interdisciplinary data evaluation form a stable base for successful projects. An early investment in competence and quality will be rewarded with a plus in efficiency and performance in the long run.

Geothermics from A to Z

DMT stands for expertise and high quality service. We have been active in the exploration of resources for more than 100 years, always expanding the limits of the technically feasible to meet our customers needs. We provide access to newest and most efficient technologies and thus make projects even more cost effective and safe. This also applies in the field of deep geothermal energy. Combining state-of-the-art equipment and the professional know-how of an interdisciplinary team, we have been internationally active for more than ten years. We can offer our customers a great variety of services in the field of geothermal energy – being a one-stop high quality service provider. Discover DMT and your possibilities in project-based exploration.

**Generate more output
from your projects**

Geophysics

Preparation
of measuring
equipment

UniVib®
in action

Geophone
(seismic
receiver)



Our services in exploration seismics

- Surveys as 2D, 3D and 4D time lapse
- Refraction seismics
- 3-component (3C) recording
- Land seismics independent of surface conditions
- Shallow water seismics (in transition zones)
in water depths up to 100 meters
- Vertical profiling

Vibration
vehicles in
action



Shallow water
seismics



Transition
zone (TZ)



We provide a valuable basis

Deep seismic site investigation has proven a successful method in crude oil exploration. Combined with up-to-date computer-assisted analysis like interactive 3D-interpretation it helps to optimise bore hole planning and increases the safety of your projects.

Seismics

To explore the underground conditions of potential geothermal deposits, we conduct measurements using different seismic sources. Our range comprises our high frequency MiniVib with 7000 lbf peak force, our UniVib with 26000 lbf peak force and the heavy duty AHV-IV with an output of 61800 lbf peak force. Besides that, our specialists use conventional explosive techniques or weight drop sources to gain best results in every situation and on all surfaces.

Shallow water seismics

DMT is also especially prepared for shallow water operations in water depths up to 100 meters. Here we use our own special boats, the airguns which are adjusted in each specific case to the required frequency spectrum and power output.

Further geophysical methods

DMT teams are also competent in further geo-physical methods and techniques which are applied ground-based as well as airborne.

- Gravimetry
- Electro magnetics
- Vertical bore hole measurement
- Magnetics
- and further more

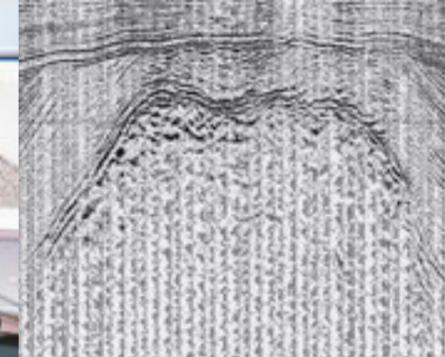


Processing team

Processing



Field processing



Transsection of a salt deposit

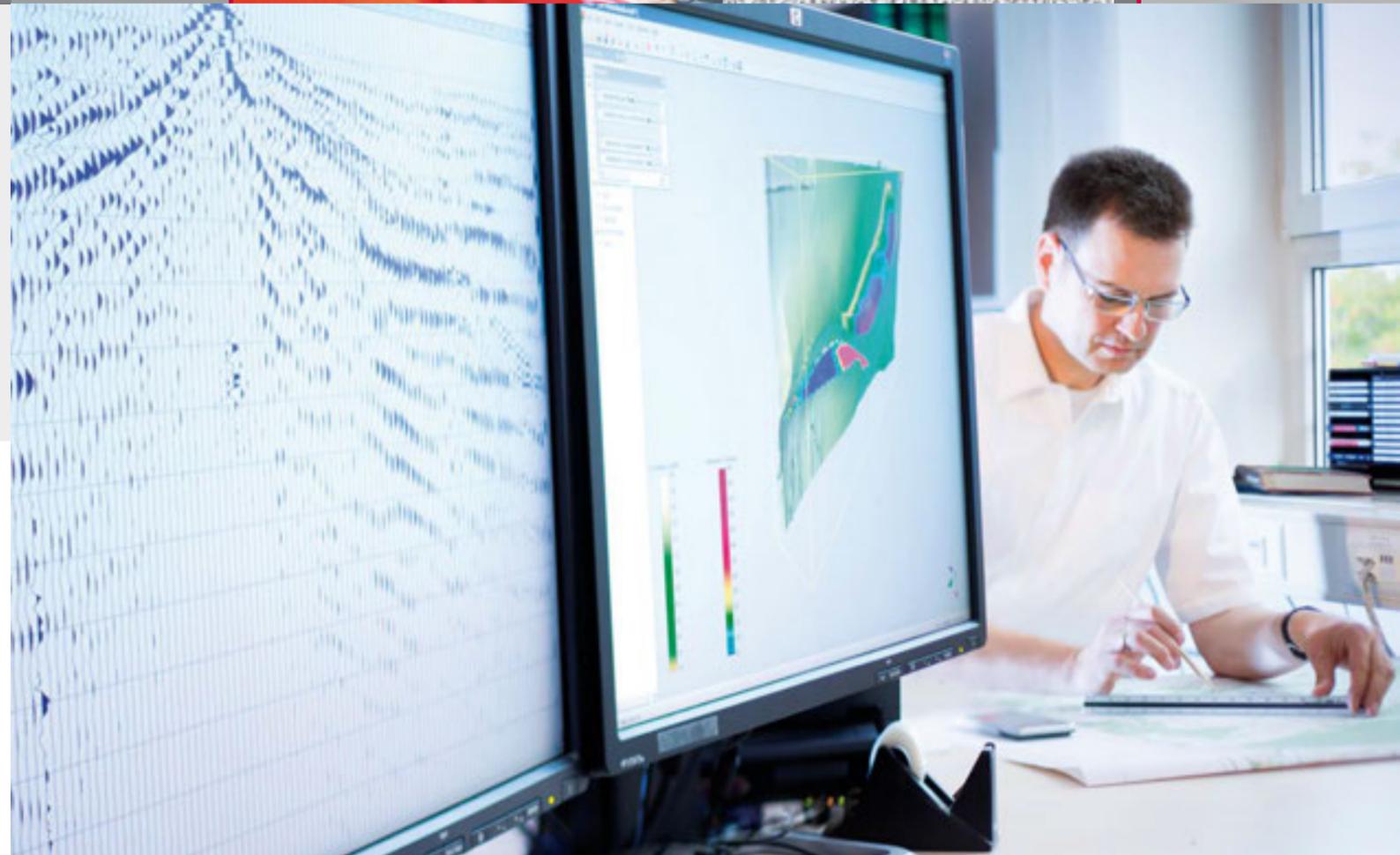
Our processing services

Standard 2D/3D processing

- Comprehensive statics solutions
- Post-stack time migration
- Re-processing of old data

Next-step data processing

- Pre-stack time migration
- Pre-stack depth migration
- Common reflection point surface stack (CRS)
- AVO



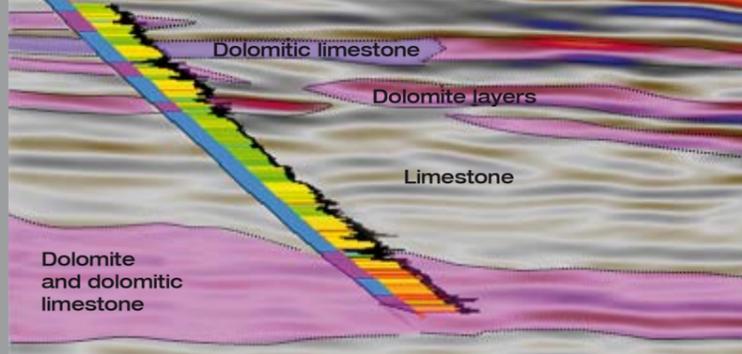
Professional data processing

Data processing is an important step in the handling of 2D/3D seismic data. The experienced specialists of DMT and Petrologic provide optimum solutions and significant results.

Processing

Thanks to their extensive experience our specialists find the best solution for every challenge in data processing. 2D or 3D, post-stack or pre-stack imaging, time or depth migration – our teams work on the most advanced technological level. This way, all data intensive processes can be executed quick and smoothly.

Of course DMT is equipped with the optimum in hard- and software. Modern cluster computers for the fastest data processing and renowned software products just as ProMAX®, DISCO®/ FOCUS®, Tsunami® Imaging Software or GOCAD® guarantee for reliable results of best quality.

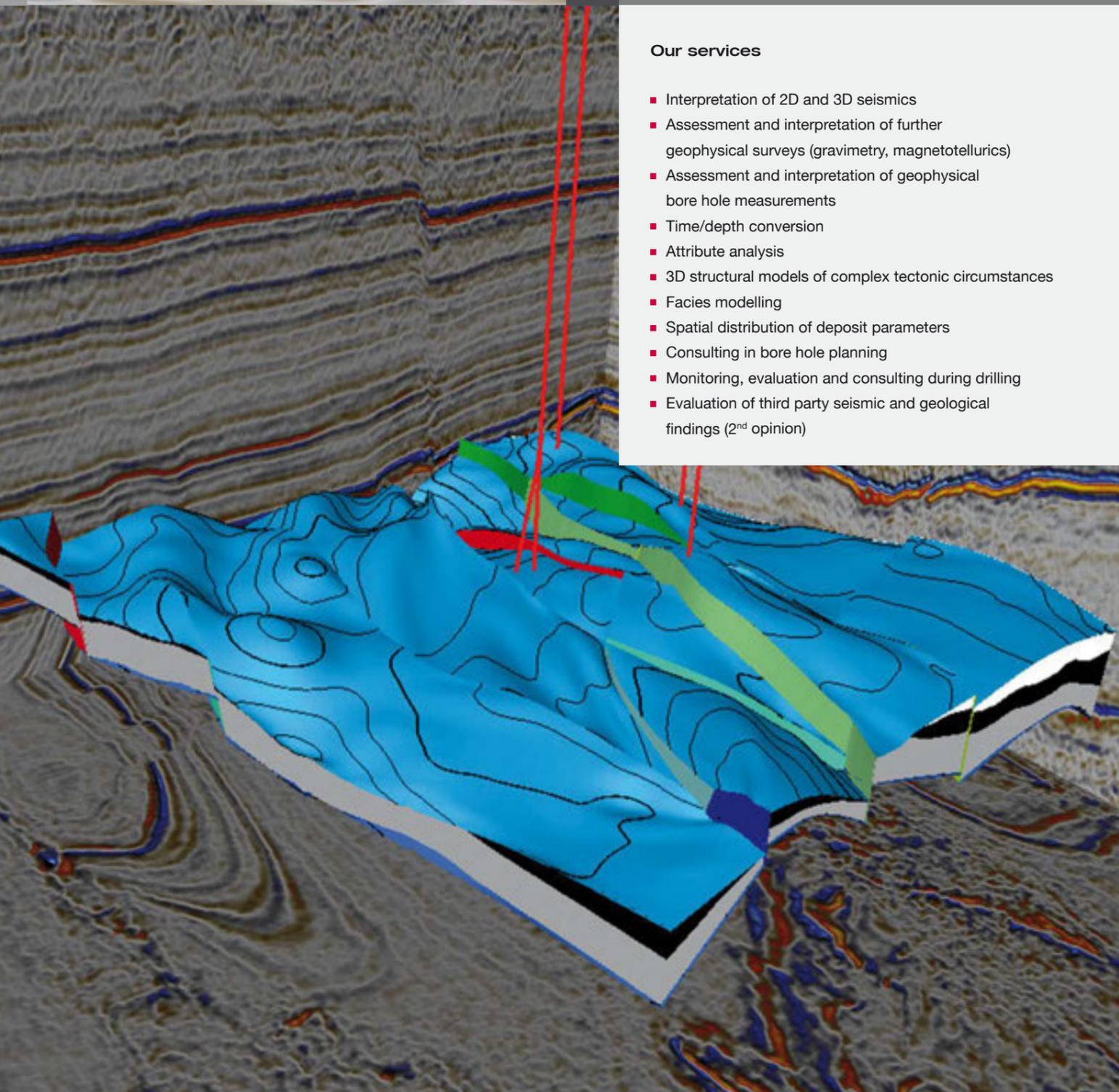


Facies model

Interpretation and seismic modelling

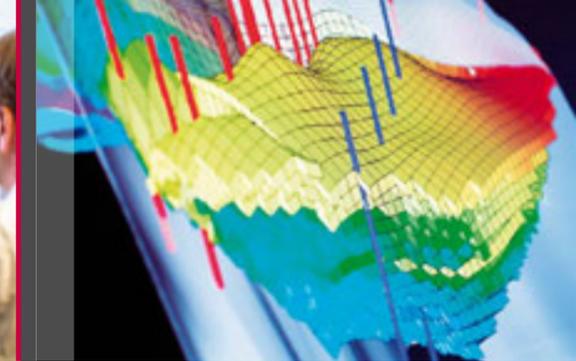
Our services

- Interpretation of 2D and 3D seismics
- Assessment and interpretation of further geophysical surveys (gravimetry, magnetotellurics)
- Assessment and interpretation of geophysical bore hole measurements
- Time/depth conversion
- Attribute analysis
- 3D structural models of complex tectonic circumstances
- Facies modelling
- Spatial distribution of deposit parameters
- Consulting in bore hole planning
- Monitoring, evaluation and consulting during drilling
- Evaluation of third party seismic and geological findings (2nd opinion)



Interactive interpretation with Petrel®

Geological block model



Underground insights in all dimensions

Our long-time experience in interpretation and modelling of geological and geophysical data combined with up-to-date software form a reliable basis for decision-making. Interdisciplinary teams are at your disposal for this task.

Experienced interpretation specialists

Geologists with comprehensive geophysical knowledge conduct evaluation and interpretation of 2D linear seismic data or 3D seismic volumes. They possess long-time experience in geothermal projects.

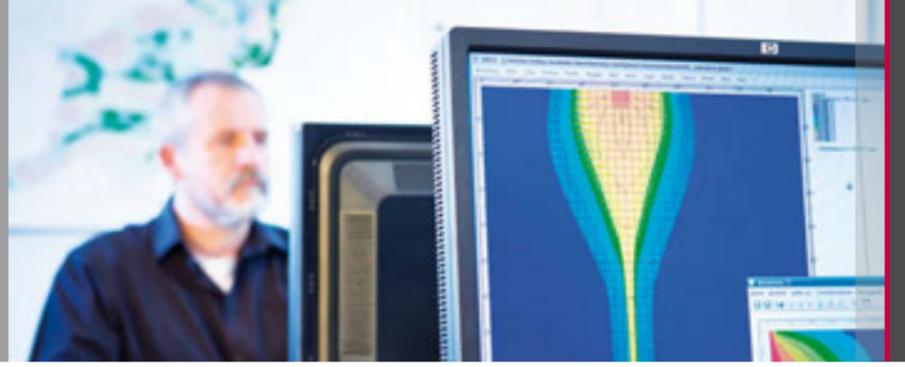
Seismic data is used to describe underground structures. Thus we can identify tectonic disruption zones which are advantageous for the exploitation of geothermal hot water potentials. By the integration of drilling data seismic reflectors can be associated with geological levels. Bore holes also provide important sampling points to convert seismic information from their initial vertical direction on a time scale into the dimension of depth. Our profound knowledge of geothermal areas in Germany also helps to reduce any uncertainties in depth predictions.

One of our standard services is the evaluation of seismic attributes to make predictions about facies formation and jointing distribution. In this field our special processing of pre stack depth migration has led to substantial improvements.

The results are incorporated in detailed 3D structural models or block models which can be directly used for the simulation of thermal deposits. Those simulations enable us to examine and predict heat transport and hydraulic flow behaviour. Our 3D underground model, which is based on seismic data, also provides the basis for bore hole planning. Results obtained during a drilling phase can quickly be integrated into the underground model, so drilling can be further optimised.

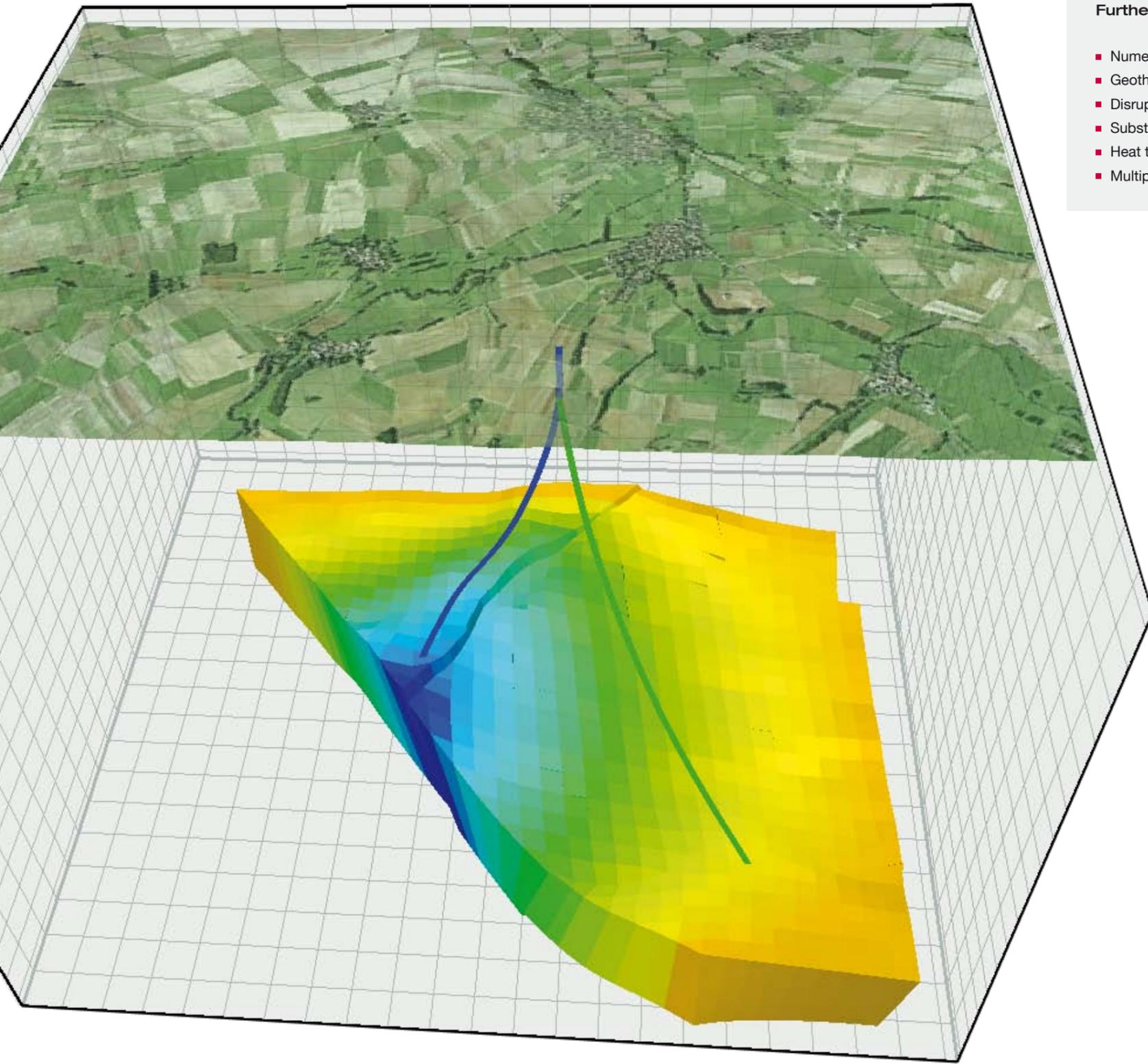
Renowned software, efficient hardware

For those services we use modern software and highly efficient hardware like Petrel® or ProMAX® to achieve maximum results for our customers. Thus we reduce risks and resources and provide planning reliability for exploration and later exploitation of the deposits.



Hydrogeology

Model of heat transport
Groundwater model during development phase
Expert discussion of a model



Further modelling services

- Numeric groundwater models
- Geothermal simulation
- Disruption models
- Substance transport and reactive substance transport
- Heat transport
- Multiple phase flow models

Realistic simulation

Detailed knowledge of reservoir characteristics is essential for a long-time efficient use of geothermal facilities. Based on geological models various usage scenarios can be simulated and thus valuable insights about heat transfers, cooling behaviour or flow characteristics may be gained.

Geothermal model

We apply numeric groundwater simulation techniques to describe water flow and heat transport. By using finite element or finite volume methods our experienced hydrogeologists gather information that is crucial for geothermal projects.

Possible applications comprise techniques to determine substance transport and reactive substance transport, heat transport or multiple phase flows. Besides that the generation of disruption models is a part of our business activities as well. Therefore we are using standard software like SPRING®, FE FLOW® and MODFLOW® as well as the ReactFlow3D software, which allows an even more flexible discretisation of geological information (e. g. imported from Petrel®) and basic conditions.



SUMMIT M Vipa
in action

Stationary
geomonitoring
system

Monitoring of
a hydraulic
stimulation



Monitoring



Our measuring equipment

- State-of-the-art vibration measurement systems
- Single survey stations
- Local seismologic measuring networks
- Comprehensive early warning and alarm systems
- 24 bit digitalisation
- Wireless networks (WLAN, GSM, UMTS)

Securing operations and surroundings

With every geothermal project, security is paramount. Use our special strength, acquired in decades of experience and through a proven record of successful projects. Covering the three domains of survey, preservation of evidence and evaluation, DMT offers a wide range of services all around seismic vibration measurements.

More protection

In the context of immission control we protect people, buildings and machinery from vibrations during construction as well as in operation. We provide the necessary verification to fulfil statutory requirements of the German Federal Mining Act (BBergG) as well as the Federal Pollution Impact Control Act (BlmschG).

More documentation

Our services in the field of evidence preservation comprise continuous monitoring, automatic measuring and data transmission as well as the long-time storage of all data acquired. Therefore, we have state-of-the-art measuring systems available. Currently, more than 100 of them are in continuous operation. Our comprehensive DMT network technology as well as analysis and database systems guarantee for reliable processing and documentation of all data.



Seismic measurements in Unterhaching, St. Gallen and Munich

References

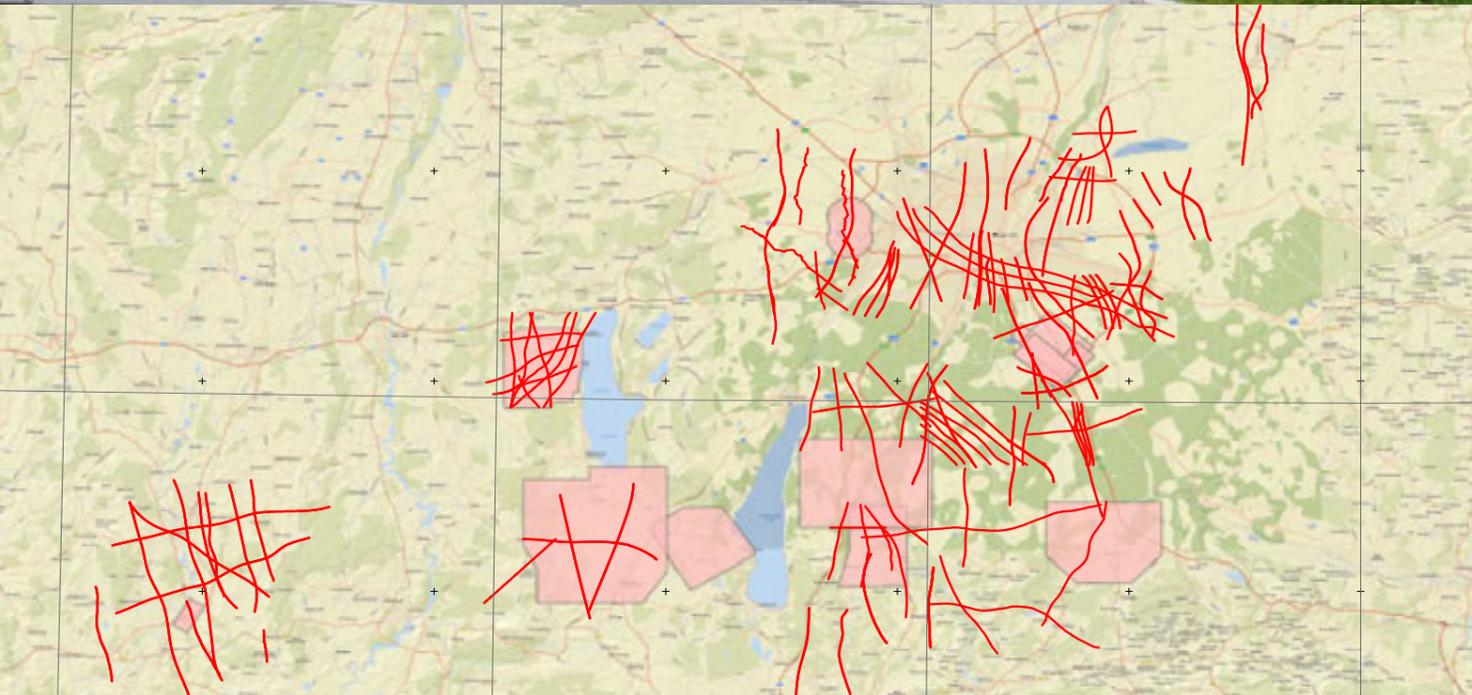
Internationally successful geothermal projects

- Germany
- Denmark
- Netherlands
- Belgium
- France
- Spain
- Japan
- Switzerland
- Liechtenstein



We make your projects a success

Best results for scientific and economic use: DMT is your reliable and flexible partner in the acquisition of seismic data – in all surroundings. Our reference list speaks a clear language.



Selected German customers of geothermal projects

GeoGlobal Energy Europe GmbH | GEOVOL
 Unterföhring GmbH | GEO Geothermie
 Traunstein GmbH | Stadtwerke München GmbH |
 Geothermische Kraftwerksgesellschaft
 Traunreut mbH | BE Geothermal GmbH |
 Überlandwerk Groß-Gerau GmbH | Gemeinde-
 werke Ismaning | A.I.R. Geokraft GmbH |
 Gemeindewerke Holzkirchen GmbH |
 Enex Power Germany GmbH | LIAG Leibniz
 Institut für Angewandte Geophysik | Stadt
 Wiesbaden | juwi GmbH | Stadtwerke
 Heidelberg | Roche Diagnostics GmbH |
 Stadtwerke Munster-Bispingen | Süddeutsche
 Geothermieprojekte GmbH | Evonik New
 Energies GmbH | GEOenergie Bayern GmbH |
 Stadtwerke Germering | BesTec for
 Nature GmbH | E.ON Bayern Wärme GmbH |
 Exorka International Ltd. | HotRock GmbH |
 First Geotherm GmbH

Selected international customers of exploration services

Enel Green Power S.p.A. | earthsolution SA |
 IDEA | Viborg Fjernvarme | Endesa SA |
 Geowatt AG | FGT/Drilltec | Gdf Suez |
 Geothermal Explorers Ltd. | RWE Dea AG |
 VITO NV | Gemeinde St. Gallen | ANDRA |
 OMV Aktiengesellschaft | Mag Industries
 International Inc | BG | AET | NAM BV |
 Tractebel | Total S.A. | ExxonMobil |
 Statoil | Wintershall | GERD Ltd. | DOW
 Chemicals | Gazprom | Vattenfall A/S |
 Preussag Energy

Picture above: ©Geothermie Unterhaching GmbH & Co. KG

Picture below: Bavarian molasse (extract)

Toolbox meeting
at the start of
a working day



Your competent partner

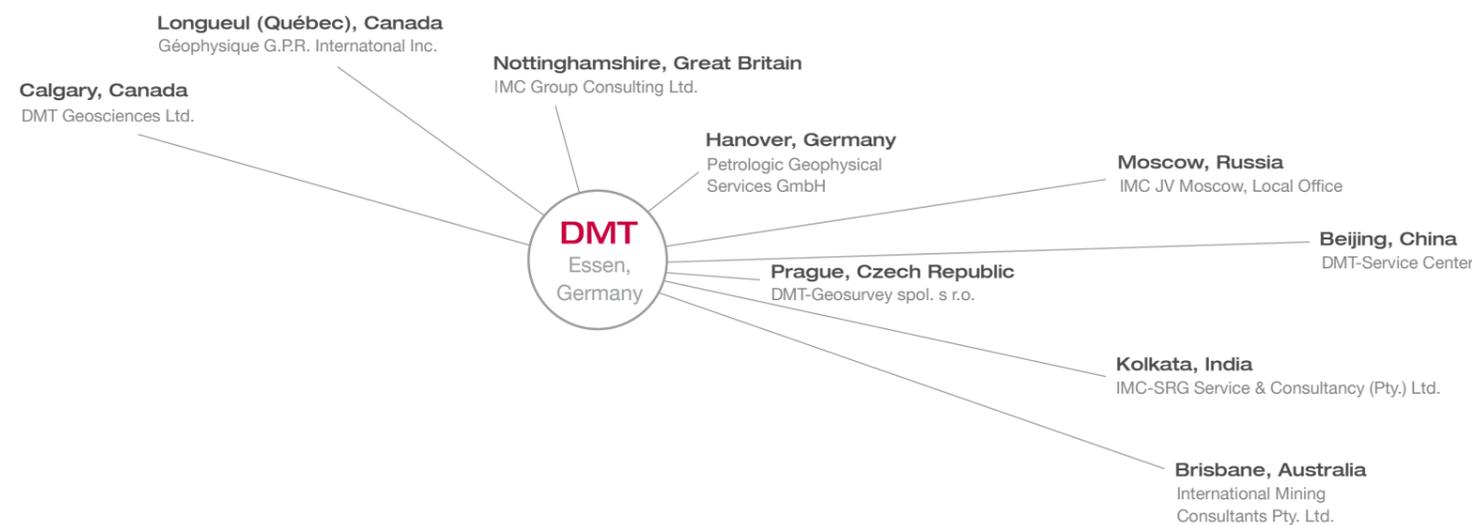
As your partner DMT is an international active, independent engineering and consulting company which specialises in the sectors of natural resources exploration, mining and coke making technology, construction and infrastructure, product testing and building safety as well as industrial testing and measuring technology.

Quality secured

In the field of Exploration & Geosurvey we are conducting geological, geophysical and geodetic surveys and studies, we render geoservices for exploration of geothermal energy, for mining, oil and gas exploitation and for special underground engineering work. Our interdisciplinary teams use sophisticated precision instruments – instruments that we developed and market around the world – to measure, process, interpret, monitor, assess and document geodata

Presence worldwide

Wherever you may need us, we are at your disposal for every geothermal project. We accompany you and offer worldwide consulting. Our knowledge, manpower and equipment have already been successfully active in diverse projects, ranging from the Canadian tar sands to Colombia's coal deposits, from salt reservoirs in Ethiopia to building grounds in Saudi-Arabia. Our service portfolio is extended continually, so DMT is regarded as a leading consulting company in the natural resources sector. We are internationally regarded as a reliable, competent partner for banks, private investors, constructors and operators.



Excerpt from DMT's QHSE Policy

Within the framework of our QHSE policy (Quality, Health, Safety, Environment) DMT is committed to offer the highest quality of service while doing the utmost to protect its personnel and the environment in which we live and work. The enhancement of the quality of our services, the health and safety of our employees, our customers, our contractors and third parties as well as the protection of the environment are an integral part of our daily operations. While striving to achieve these ambitious goals we have put systems in place to improve the quality of our services, identify hazards, assess risks and introduce appropriate prevention. A continuous audit and review programme conducted by our operative management ensures the effectiveness of our management system – to the benefit of all.

Special training for extraordinary project situations



Four objectives of the QHSE Management System

Q as in Quality:

A clear organisation, structure and guidance for all personnel minimise the risk of incidents due to personnel not knowing how to perform their job.

H as in Health:

Measures to protect the health of all our personnel at the workplace minimise the risk of work-related illnesses and disabilities.

S as in Safety:

A safe working environment minimises any hazardous incidents that could lead to personal injury or death.

E as in Environment:

Operating in an environmentally responsible manner minimises the risk of environmental pollution, irreversible damage and the loss of natural biotopes.

Elements of our QHSE Management System

DMT uses a top-down approach ranging from institutional level to our separate departments and down to the single workplace. Our QHSE system consists of seven elements. A committed leadership and a clear distribution of roles and

responsibilities are supplemented by a thorough evaluation and risk management. Further elements comprise planning, implementation, monitoring and concluding audits and reviews.

Certificates of our QHSE system

The QHSE management system is based on the following international standards:

- ISO 9001 – Quality Management
- ISO 14001 – Environmental Management
- OHSAS 18001 – Occupational Health and Safety Management

Moreover various guideline documents of the following industry-specific bodies were referred to:

- OGP – International Association of Oil and Gas Producers, London, UK & Houston, USA
- IAGC – International Association of Geophysical Contractors, Houston, USA

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