Towards a Harmonised Geothermal Information Platform: Introduction to the INSPIRE Directive and its Implications

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Workshop on the Danube Region Geothermal Concept (DanReGeotherm)

Budapest, 28 November 2013

- **What is INSPIRE?**
- **Who is it made for?**
- **What is behind?**
- **How does geothermal energy fit into all this?**

What is INSPIRE ?

It is a European **directive** that came into force in **2007** and will be fully implemented by **2019**.

It aims to create a European Union (EU) **spatial data infrastructure**. This will enable the **sharing** of environmental **spatial information** among public sector organisations and better **facilitate public access** to spatial information across Europe.

A European Spatial Data Infrastructure will assist in **policy-making** across boundaries. Therefore the spatial information considered under the directive is **extensive** and includes a great variety of **topical and technical themes**.

INSPIRE Principles

- Data should be collected only once and kept where it can be maintained most effectively.
- It should be possible to combine seamless spatial information from different sources across Europe and share it with many users and applications.
- It should be possible for information collected at one level/scale to be shared with all levels/scales; detailed for thorough investigations, general for strategic purposes.
- Geographic information needed for good governance at all levels should be readily and transparently available.
- Easy to find what geographic information is available, how it can be used to meet a particular need, and under which conditions it can be acquired and used.

Who is INSPIRE made for?

- Citizens who are interested in their environment
- Policy makers
- Environmental domain experts
- Scientists
- For those who are interested in any of the 34 themes

INSPIRE Spatial Data Themes

ANNEX I

1 Coordinate reference systems
2 Geographical grid systems
3 Geographical names
4 Administrative units
5 Addresses
6 Cadastral parcels
7 Transport networks
8 Hydrography
9 Protected sites

ANNEX II

1 Elevation
2 Land cover
3 Orthoimagery
4 Geology

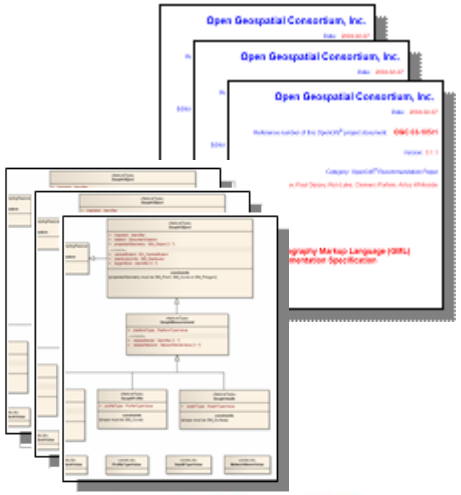
ANNEX III

1 Statistical units
2 Buildings
3 Soil
4 Land use
5 Human health and safety
6 Utility and governmental services
7 Environmental monitoring Facilities
8 Production and industrial facilities
9 Agricultural and aquaculture facilities
10 Population distribution and demography
11 Area management / restriction / regulation zones & reporting units
12 Natural risk zones
13 Atmospheric conditions
14 Meteorological geographical features
15 Oceanographic geographical features
16 Sea regions
17 Bio-geographical regions
18 Habitats and biotopes
19 Species distribution
20 Energy Resources
21 Mineral Resources

What is Behind?

Conceptual background

- International and Industrial Standards
- Common Datamodel for all 34 INSPIRE Themes



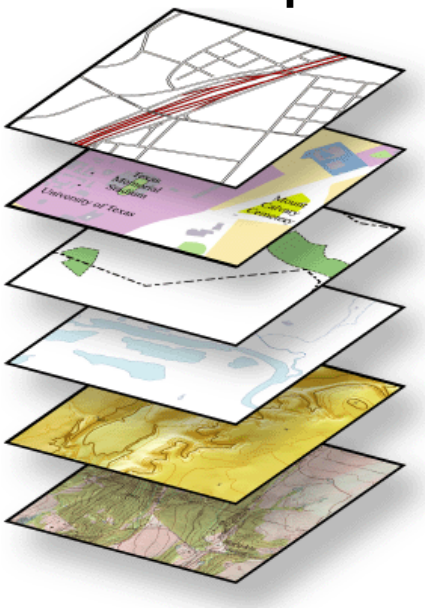
Technical Background

- OGC Web Services (WMS, WFS, WCS …)
  - discovery, view, download, …
- Harmonized Datasets

All European member states and more than 3000 institutions

Metadata in INSPIRE

Thematic maps



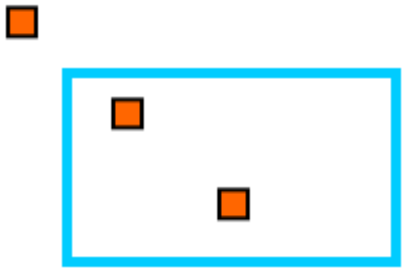
Dataset Metadata

ISO 19139
XML

Service Metadata

ISO 19139
XML

Spatial Objects (Features)



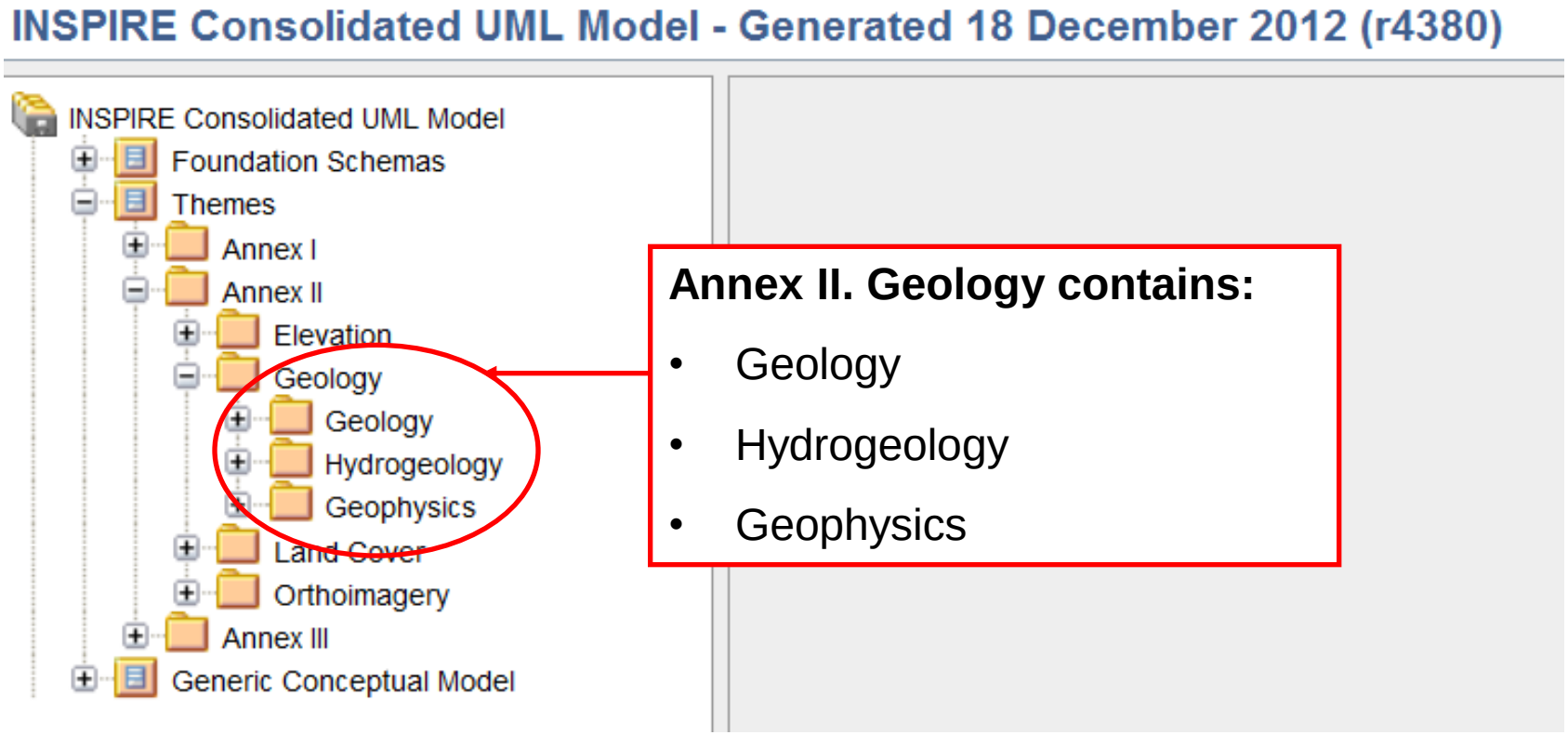
Feature Metadata

INSPIRE
GML

Observation Metada

O&M
XML

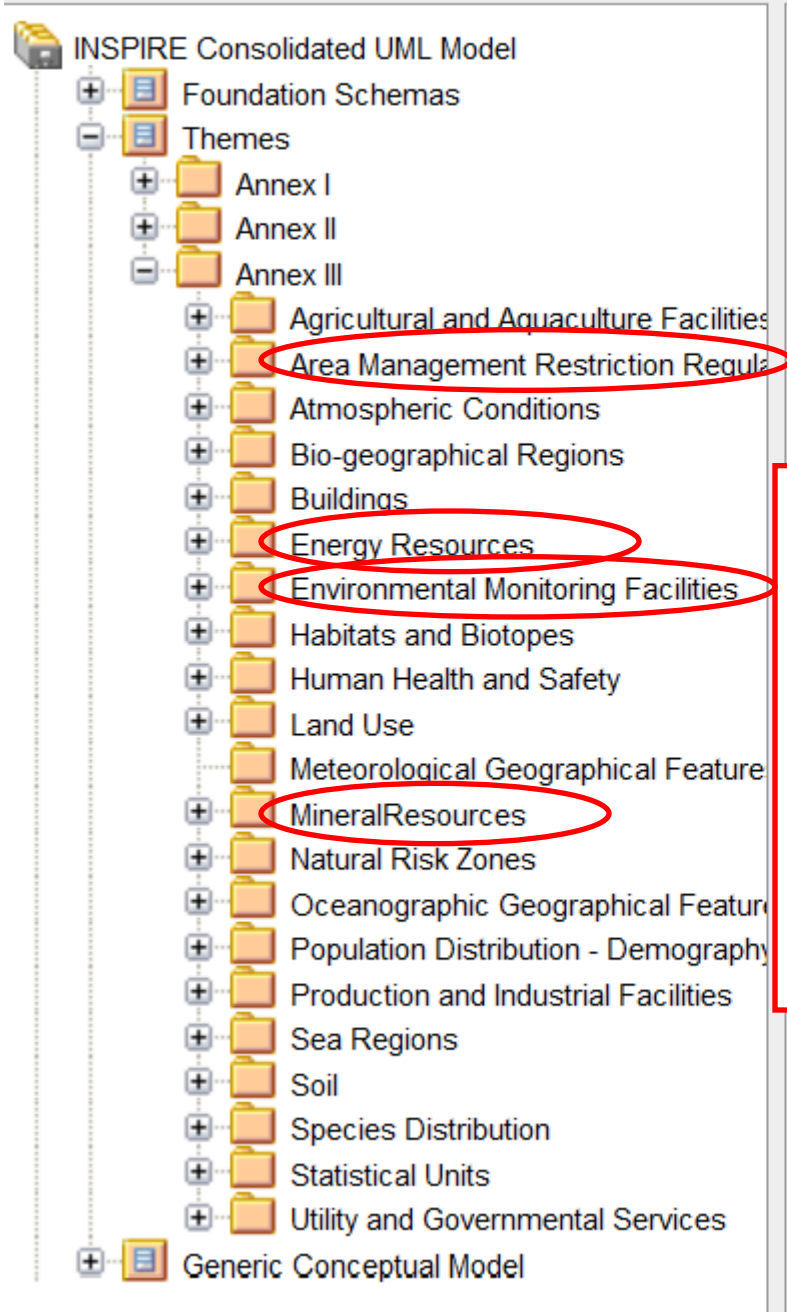
How does geothermal energy fit into INSPIRE?



Annex II. Geology contains:

- Geology
- Hydrogeology
- Geophysics

INSPIRE Consolidated UML Model - Generated 18 December 2012 (r4380)



Themes : Public Package

Created: 3/17/2008 11:58:16 AM
Modified: 3/17/2008 11:58:16 AM

Project:
Advanced:

Annex III. contains:

- Area Management Restriction & Regulation Zones
- Energy Resources
- Environmental Monitoring Facilities
- Mineral Resources

How does geothermal energy fit into INSPIRE?

INSPIRE spatial object types (feature level metadata)

Annex II. Geology, Hydrogeology, Geophysics:
Geological environment: *GeologicFeature, Aquifer, Aquitard…*
Exploration related information: *Borehole, Geophysical survey* …

Annex III. Energy Resources:
Spatial extent and Geothermal potential data: *RenewableAndWasteResource, RenewableAndWastePotentialCoverage*

Annex III. Environmental Monitoring Facilities:
Monitoring of Temperature, pressure, chemical composition:
EnvironmentalMonitoringFacility, EnvironmentalMonitoringNetwork…

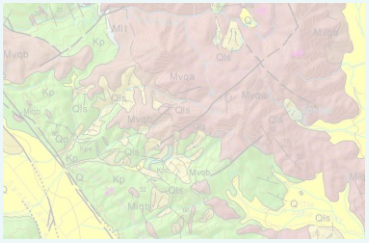
How does geothermal energy fit into INSPIRE?

Observation metadata and results

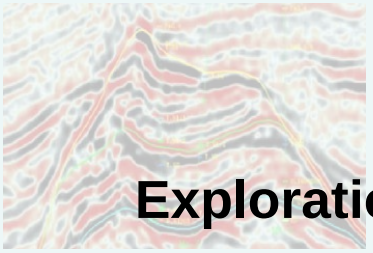
Observations and Measurements (ISO-19156)
Detailed information on measurements: *SamplingFeature, Process, Result …*

GML coverage Model:
Curves, Profiles, Maps, Volumes: *CurveCoverage, SurfaceCoverage, RectifiedGridCoverage, ReferenceableGridCoverage…*

SWE, SensorML:
Data, Data, Data …

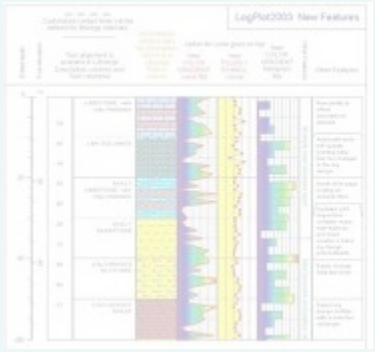


Geological map
MappedFeature

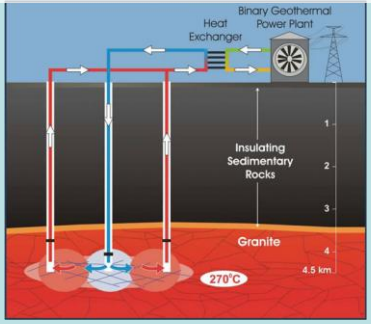


Seismic Profile
GeophProfile

Exploration phase



Borehole
Borehole,
BorholeLog



Geothermal Well
RenewableAnd-
WasteResource

Observation & Measurement

- *featureOfInterest*
- *responsible*
- *phenomenonTime*
- *resultTime*
- *observedProperty*

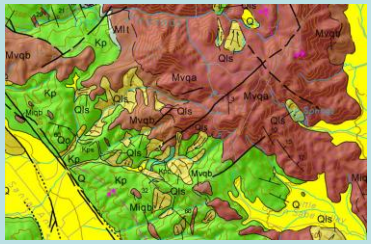
OM_Process

p.e:
fieldObservation
seismicDataAcq.
geochemicalAnal.
pumpingTest
temperatureLogging
productionRateMeas.

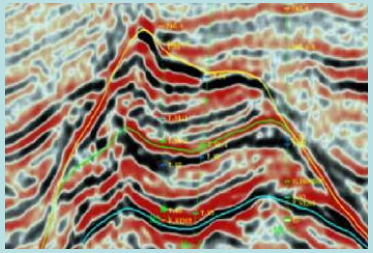
Result

p.e:
geological map
seismicSection
chem.Composition
temperatureLog
productionRateLog

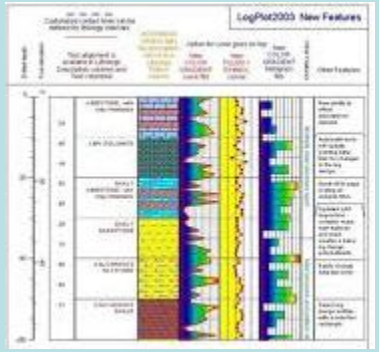
GML, SensorML,
SEG-Y, LAS,
JPG, any other…



Geological map
MappedFeature



Seismic Profile
GeophProfile



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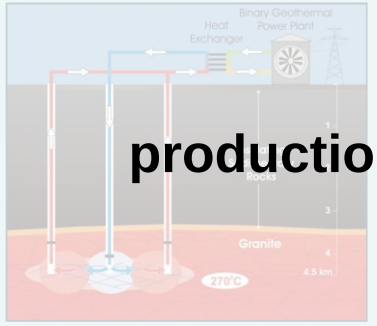
Borehole,
BorholeLog



Geothermal Well
RenewableAnd-
WasteResource

production phase

Observation & Measurement

- *featureOfInterest*
- *responsible*
- *phenomenonTime*
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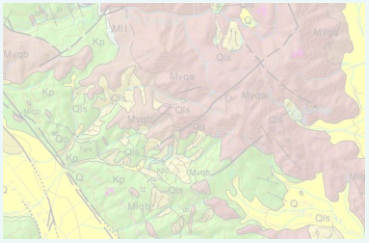

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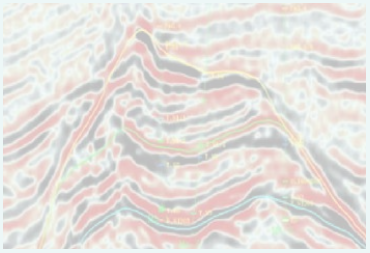
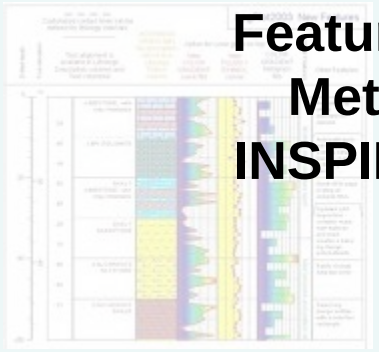
MappedFeature

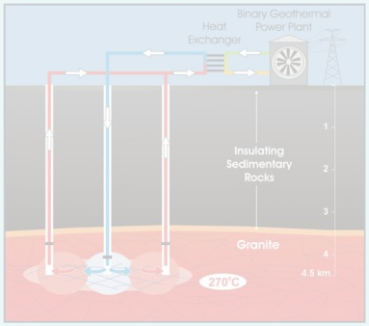


Seismic Profile
GeophProfile



Feature Level Metadata INSPIRE XML

Borehole
Borehole,
BorholeLog



Geothermal Well
RenewableAnd-
WasteResource

Observation & Measurement

- *featureOfInterest*
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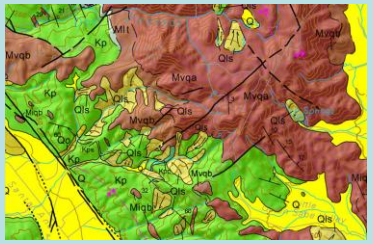

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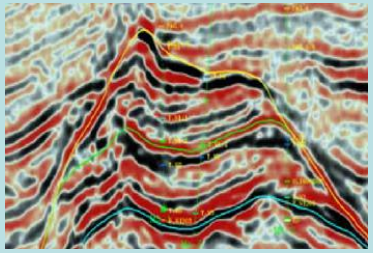

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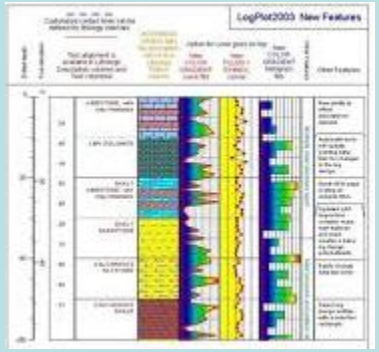

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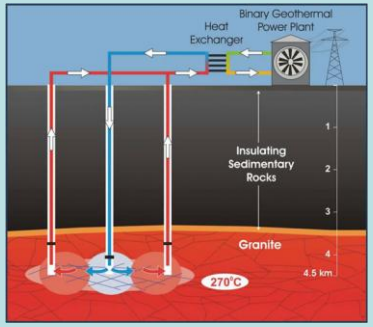

Geothermal Well
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Observation Metadata
O&M XML, SWE, SensorML

Observation & Measurement

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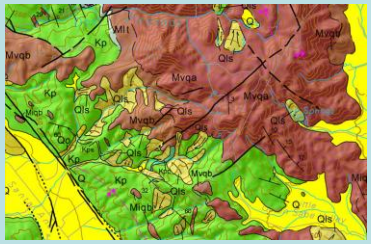

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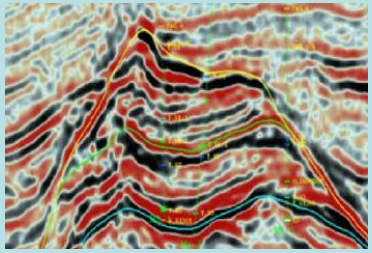
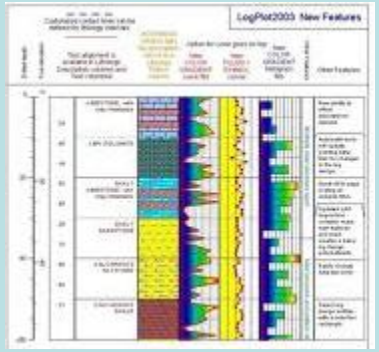


Seismic Profile
GeophProfile



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Borehole,
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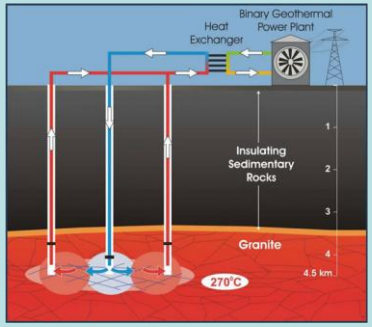

Geothermal Well
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Observation & Measurement

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Data
GML
or any other…

GML, SensorML,
SEG-Y, LAS,
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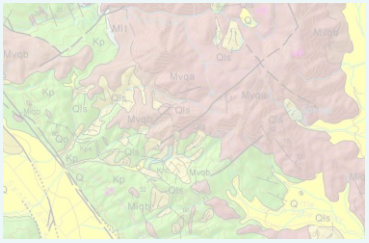
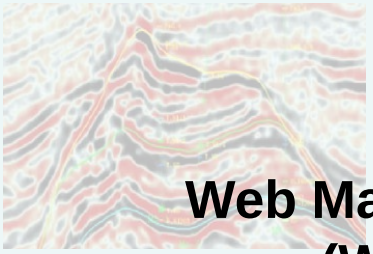
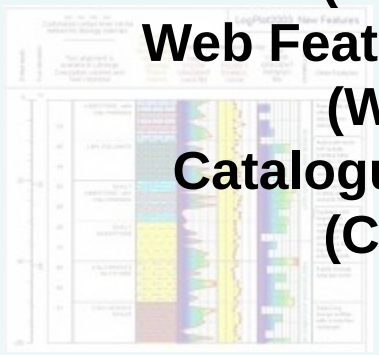


Geological map
MappedFeature

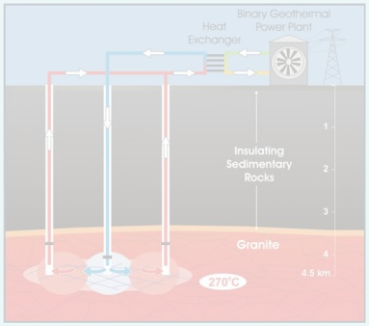


Seismic Profile
GeophProfile

Web Map Service (WMS)
Web Feature Service (WFS)
Catalogue Service (CSW)



Borehole
Borehole,
BoreholeLog



Geothermal Well
RenewableAnd-WasteResource

Observation & Measurement

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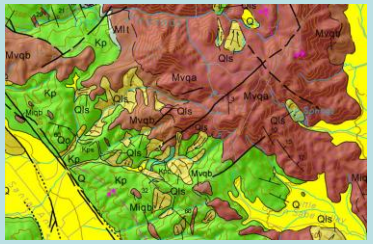
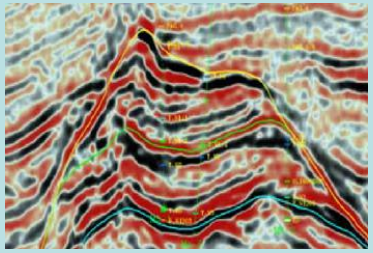
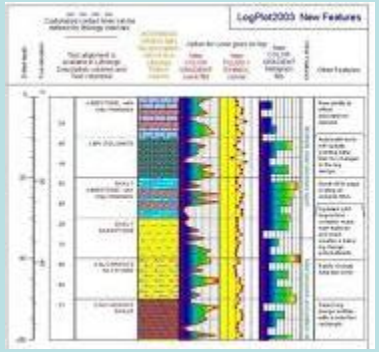


Geological map
MappedFeature



Seismic Profile
GeophProfile



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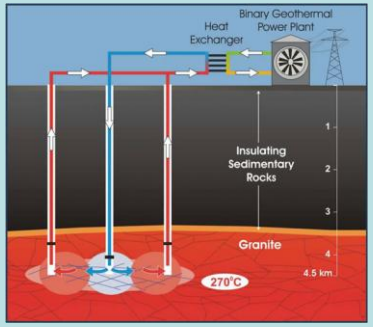

Geothermal Well
RenewableAnd-
WasteResource

Observation & Measurement

Sensor Observation Service (SOS)

- *featureOfInterest*
- *responsible*
- *phenomenonTime*
- *resultTime*
- *observedProperty*

OM_Process

p.e:
fieldObservation
seismicDataAcq.
geochemicalAnal.
pumpingTest
temperatureLogging
[illegible]Meas.

Result

p.e:
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GML, SensorML,
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Conclusions

1. INSPIRE provides full featured spatial object types for exploration, production and monitoring phase to share high level metadata about geothermal objects
2. Observation and Measurement standard makes it possible to :
   a) encode any kind of measurements in a common way
   b) being able to read and understand deep technical details
   c) describe processes and distribute results
3. Using harmonized datasets and OGC web services will ensure that:
   a) partners can access each others data seamlessly
   b) data remain available to web service based future technologies
4. European Member State partners fulfil their leagal obligations

Keywords: **Interoperability, Harmonization**

Thank You for the Attention