High temperature, high precision, temperature measurement probe

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High precision temperature measurements

High precision temperature tools allow accurate temperature logs to be performed and geological events to be characterized in geothermal wells. In the framework of the European HITI project, BRGM will transfer his experience from low temperature domain (0-130 °C) to high temperature domain (up to 320 °C)

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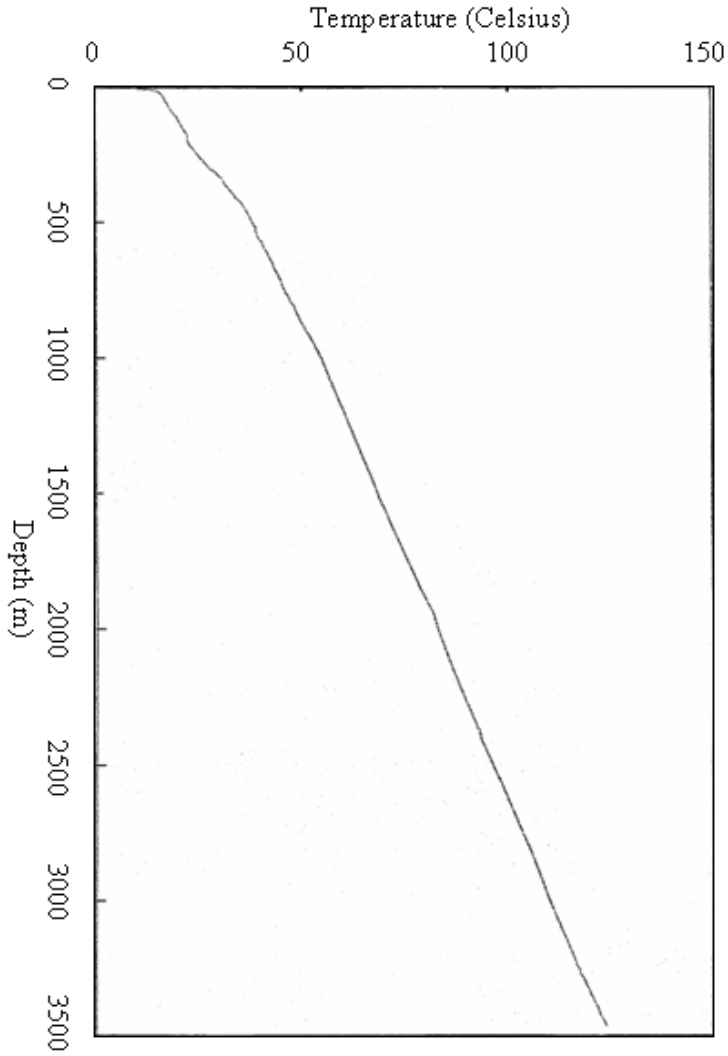
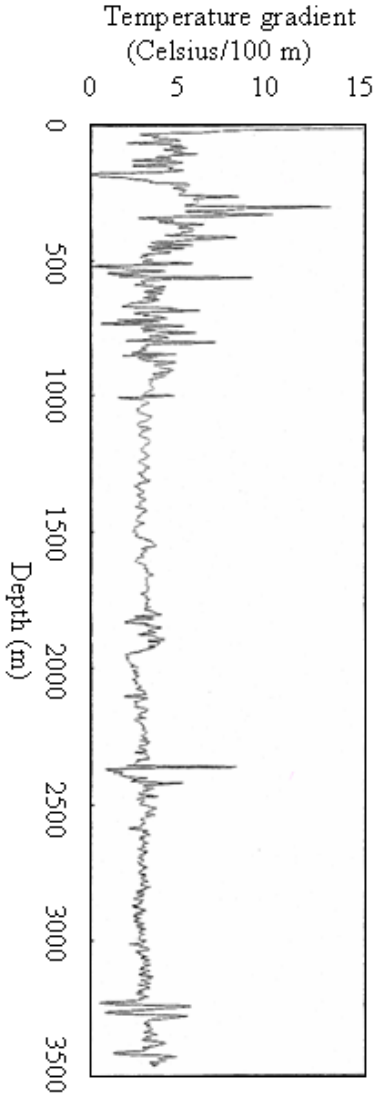
Temperature measurements in Couy borehole, France (3500 m deep)





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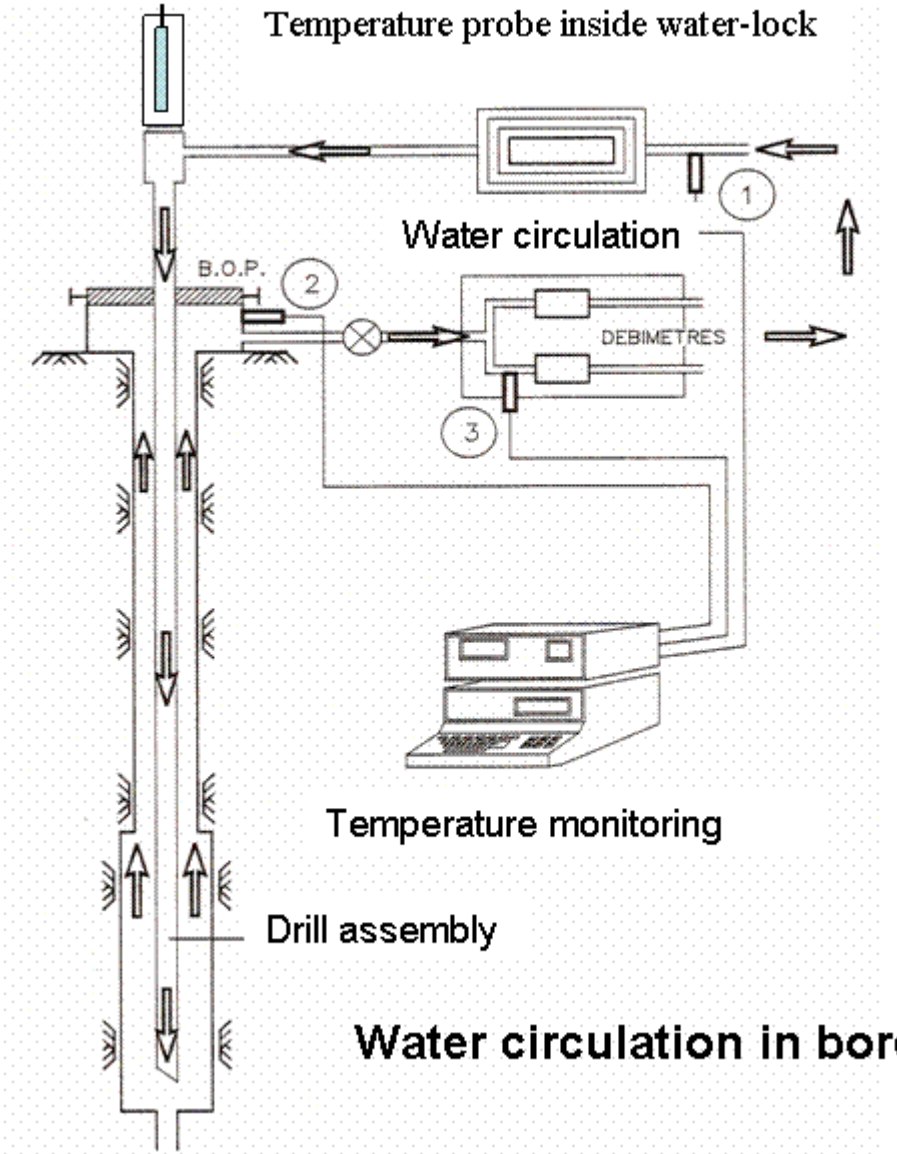
Water flow detection



Water circulation in borehole

A) Measurement procedure

- Natural water flow is stopped by a lock with temperature probe inside. The temperature of water is equalized by water circulation (150 l/mn).
- Water circulation is stopped and the first temperature log is performed through the water-lock, the open BOP and the drill assembly.
- Water-lock is open to let water naturally flow out (# 3 l/mn), and the second temperature log is performed.

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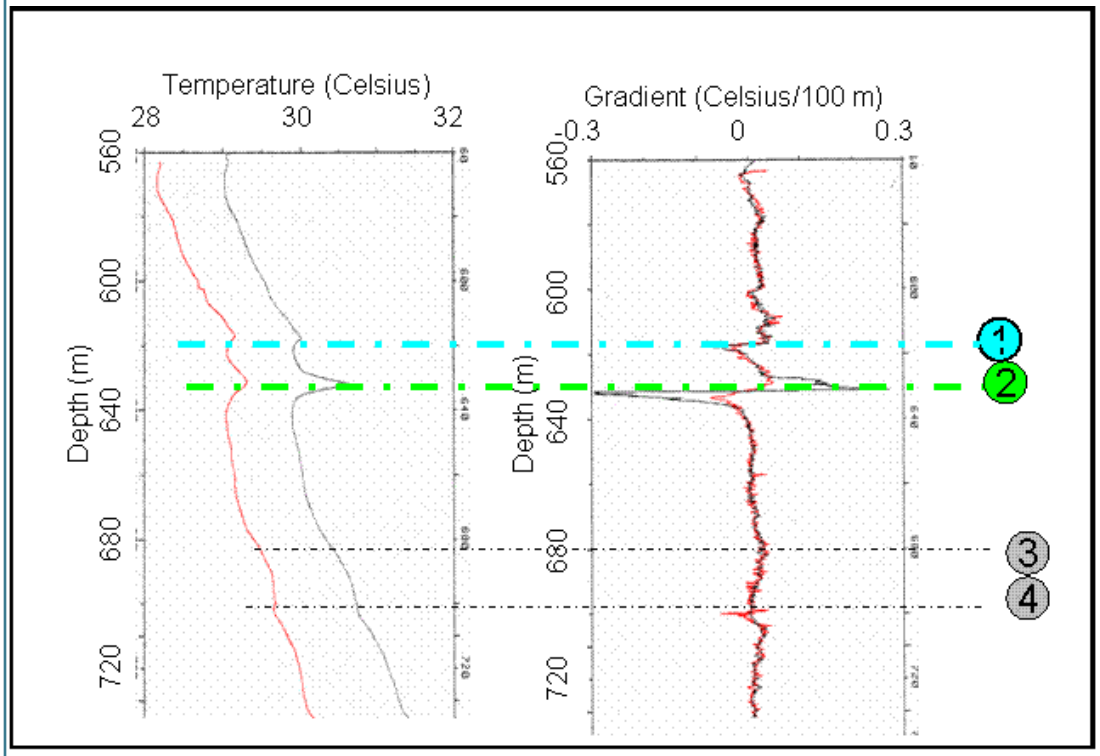
Water flow detection: measurements



1 2 Water flow

3 4 Petrologic changes

B) Measurements results

First temperature measurements and computed temperature gradient logs show (in red):

- Mean gradient level near to 0 (equalized water)
- Two levels of water flow (1 and 2),
- Petrologic levels (for example: 3 = marls, 4 = limestones).

Second temperature measurements and computed temperature gradient logs show (in black):

- Higher temperature level (+ 1 °C),
- No change of the gradient log general shape,
- Much higher amplitude of thermal gradient beside water flow level 2

C) Conclusion

Measurements show two water flow levels; main water flow comes from level 2, maybe due to local fracturing of limestone, as level 1 may be due only to limestone porosity.

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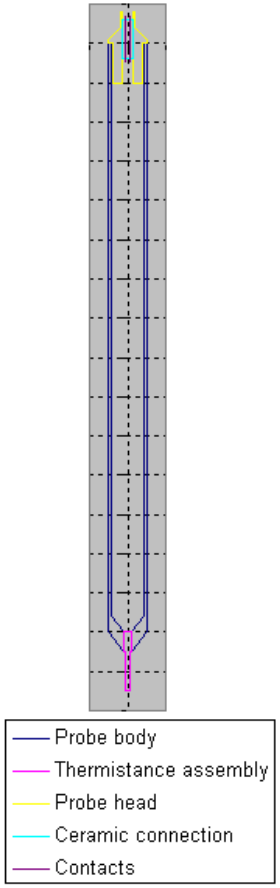

Specifications:

Precision:	0.01°C
Sensitivity:	0.003 °C
Range :	0 to 350 °C
Pressure :	500 bars

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