



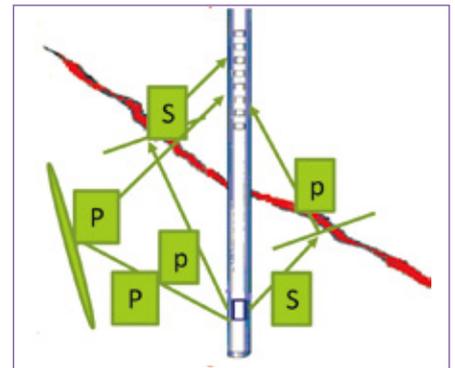
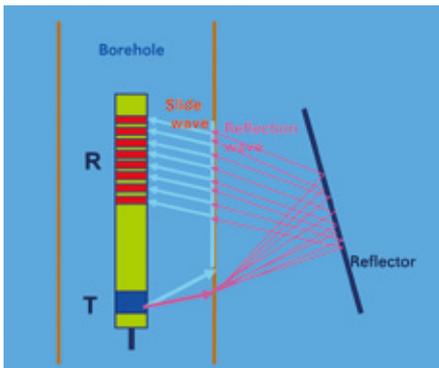
BH-ARI Acoustic Reflection Imaging Logging Technology

China National Petroleum Corporation

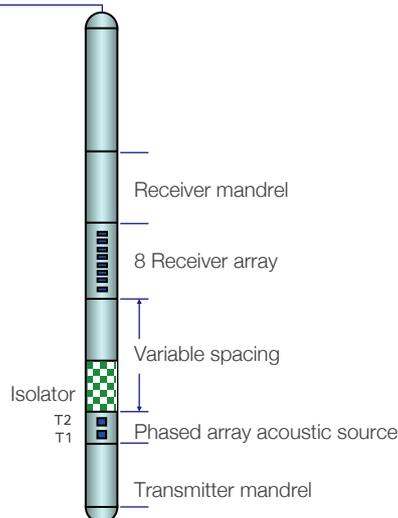


BH-ARI is a new type of integrated geologic logging evaluation technology covering methods, tools, data processing and interpretation, and comprehensive evaluation. It can be used to detect physical properties of fractured or vuggy formations within 10 meters around the wellbore, providing an effective means for detailed characterization and evaluation of fractured reservoirs.

The technical carrier of BH-ARI, the far-detecting acoustic reflection imaging logging tool, is mainly composed of the transmitting circuit, transmitting acoustic system, variable spacing, receiving acoustic system, receiving circuit and other subs. During logging, acoustic signals are sent from the sound source and enter into the formation, and then reflect when encounter small geological structures. The reflected signals are received by the receiving probe which amplifies the signals and sends them to the ground for record and storage. Then, special software is used for processing, analysis and identification.



The far-detecting acoustic reflection imaging logging tool is composed of 5 working modules: the reflected wave logging module, the adjustable two-way transmission module, the variable spacing measuring module, the low-frequency high-power transmitting probe and the broadband high-sensitivity receiving probe, and the digital processing module combined with seismic exploration.

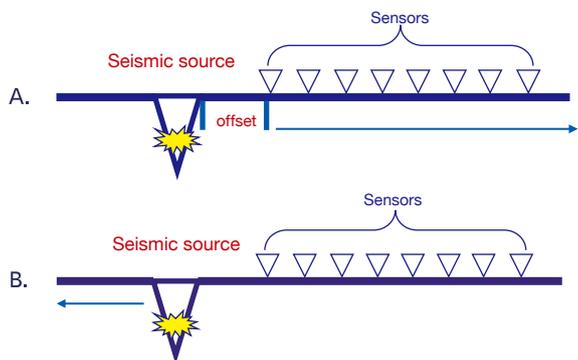


Specifications

- ✓ Max. Temp: 350°F
- ✓ Max. Pressure: 20,000psi
- ✓ Length: 17.9-30m
- ✓ Max O.D: 4" (90-102mm)
- ✓ Logging SPD: ≤9m/min

Main Features

- ✔ New reflection acoustic acquisition system



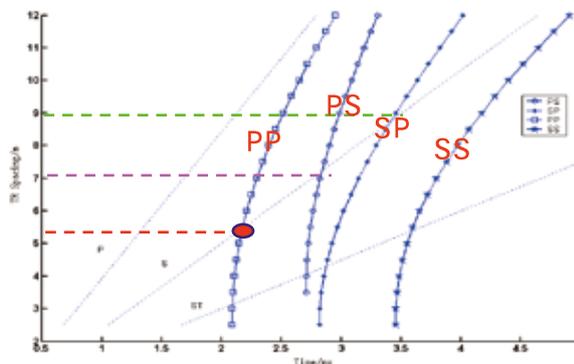
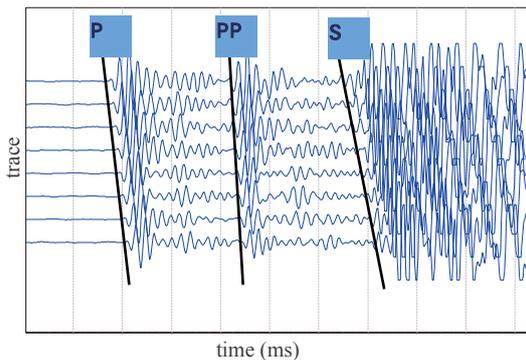
- ✔ Phased array acoustic source

Transmitter

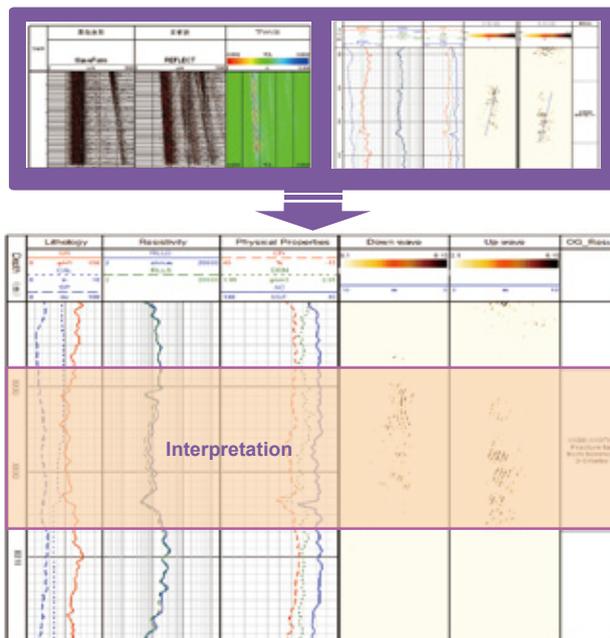
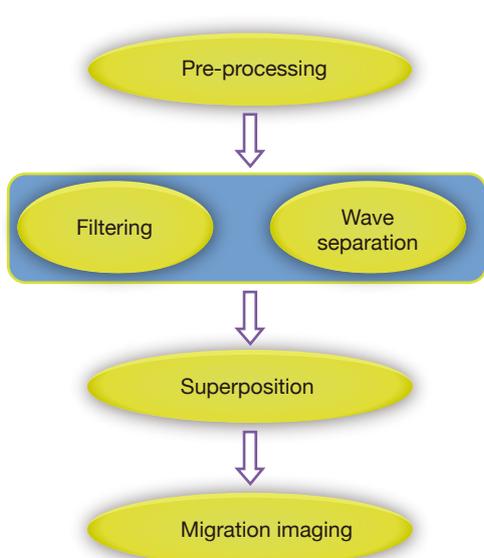
- Oriented transmission
- Transmission energy increased

R
T
Carbonate

- ✔ Variable spacing



- ✔ Advanced data processing technique

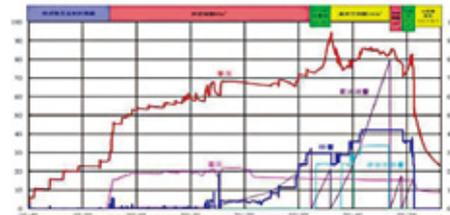
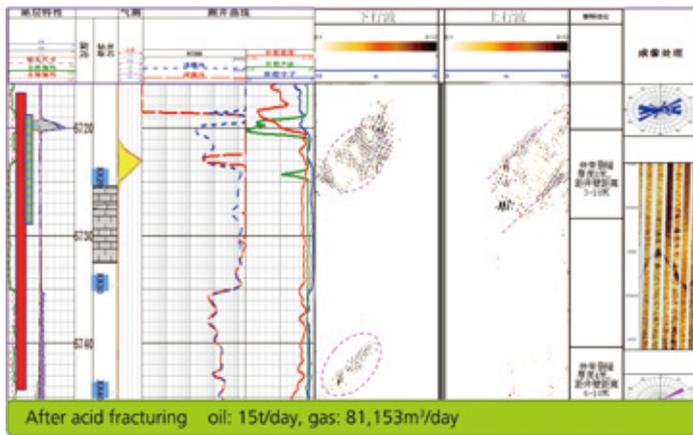


Application

Field application has shown that, with this technology, we can better identify the fractures around the wellbore and evaluate the fractured or vuggy reservoirs than by conventional logging methods. The response characteristics of reflected waves for three types of fractured reservoirs (fractures around wellbore, fractures across borehole wall, and corrosion vugs) and the thickness of effective reservoirs can be better understood, providing a reliable basis for hydrocarbon geological reserve calculation and formation fracturing operation.

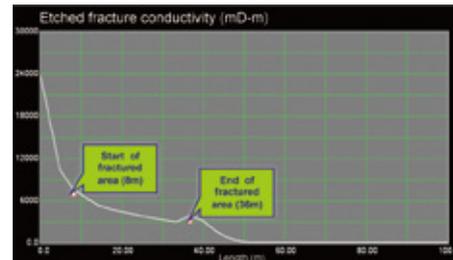
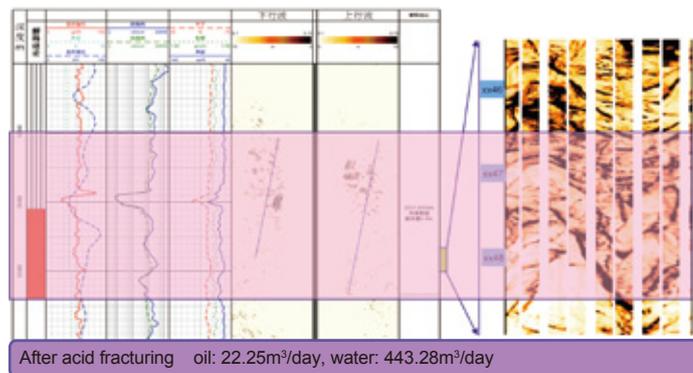
The BH-ARI technology has been applied to over 106 wells in the Tarim, Daqing, Liaohe, Dagang, Huabei, and Sichuan oilfields. As to the 45 wells in the Tarim Oilfield, a success rate of fractured reservoir identification of 88.2% was reached. Favorable results have been achieved in evaluating carbonate, igneous and granite fractured/caved reservoirs.

Carbonate formation



- ✓ Pressure curve during acid fracturing
- ✓ Pressure sharply declining indicates fracture connecting

Granite formation



- ✓ Interpretation after acid fracturing
- ✓ The fracture starts at 8 meters and ends at 36 meters