



Formation Imaging at the Wayang Windu Geothermal Field, West Java, Indonesia

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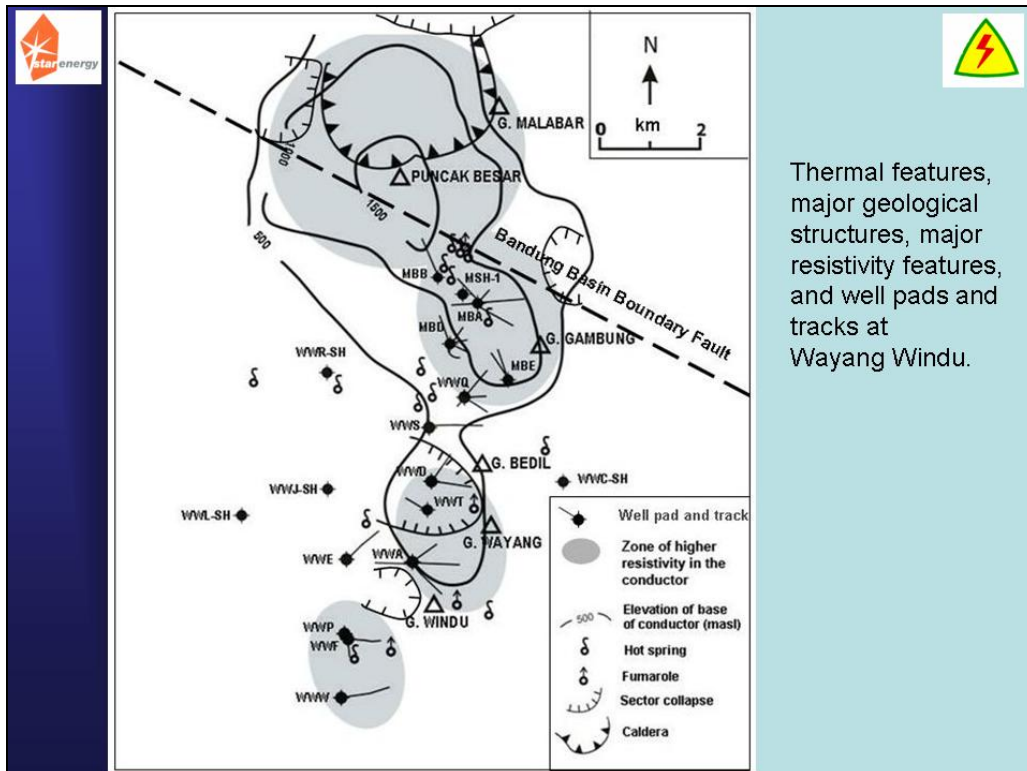
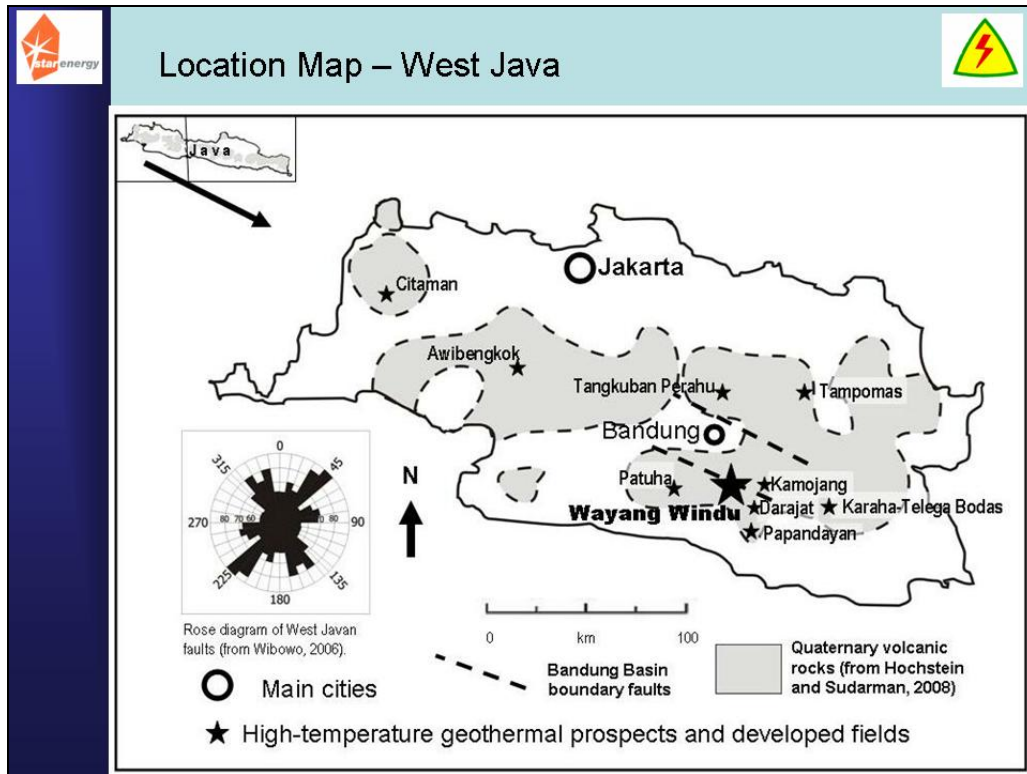


Formation Imaging at the Wayang Windu Geothermal Field, West Java, Indonesia

- Review of Wayang Windu Geothermal Field (Bogie et al., 2008)
- Range of information obtained by formation imaging
- Examples from Wayang Windu and application to well targeting

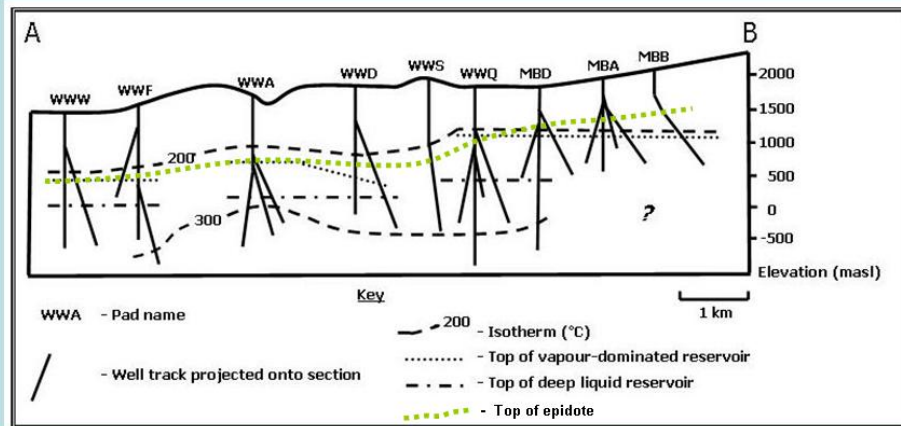


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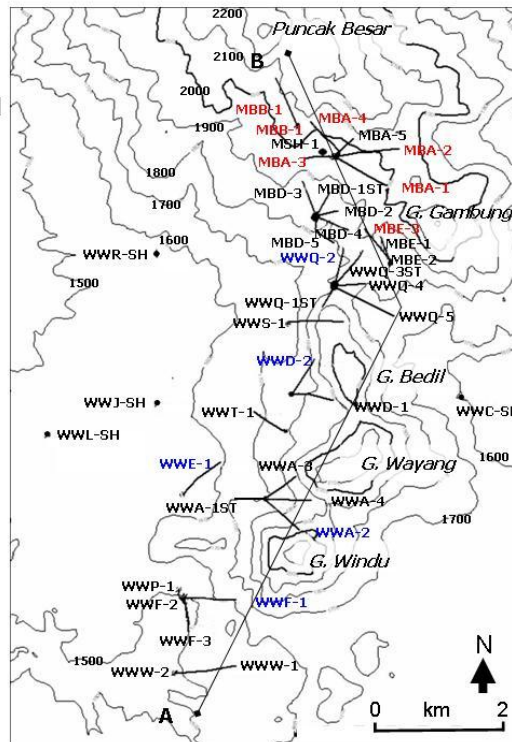




Temperature, reservoir and epidote distribution at Wayang Windu



Topographic map with well pads and tracks; with logged wells indicated.

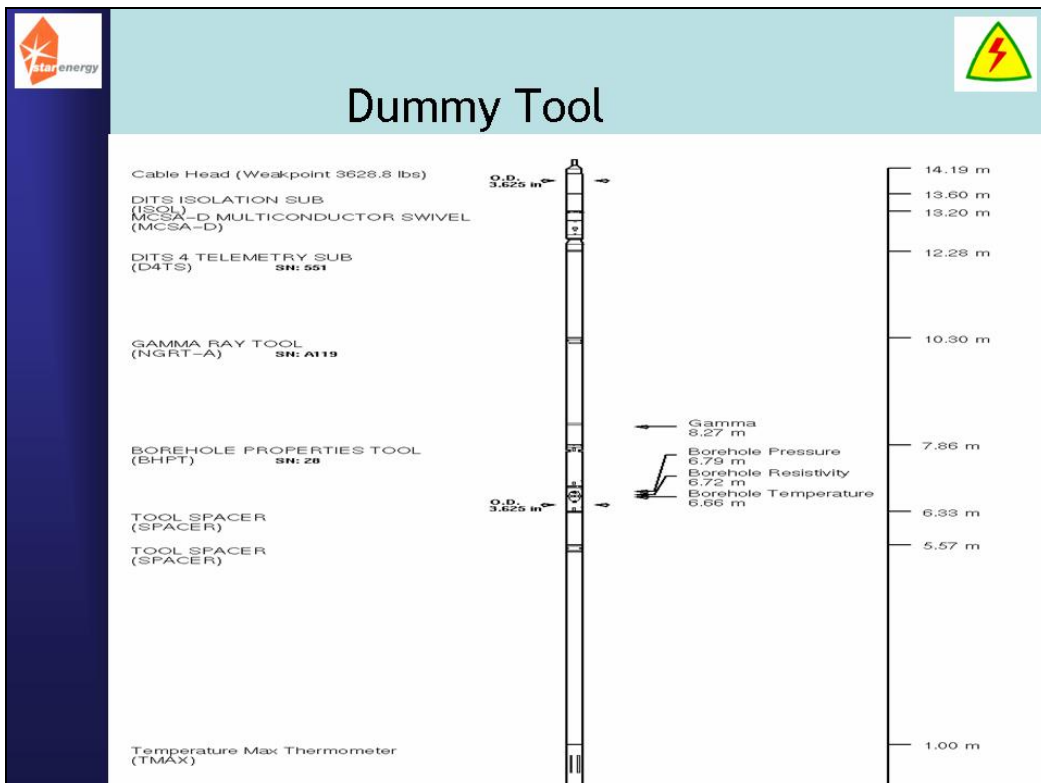


Key

- / Well pads and tracks
- WWE-1 Well in which Schlumberger FMI or FMS was run
- MBB-1 Well in which Halliburton XRFMI was run
- A Section line



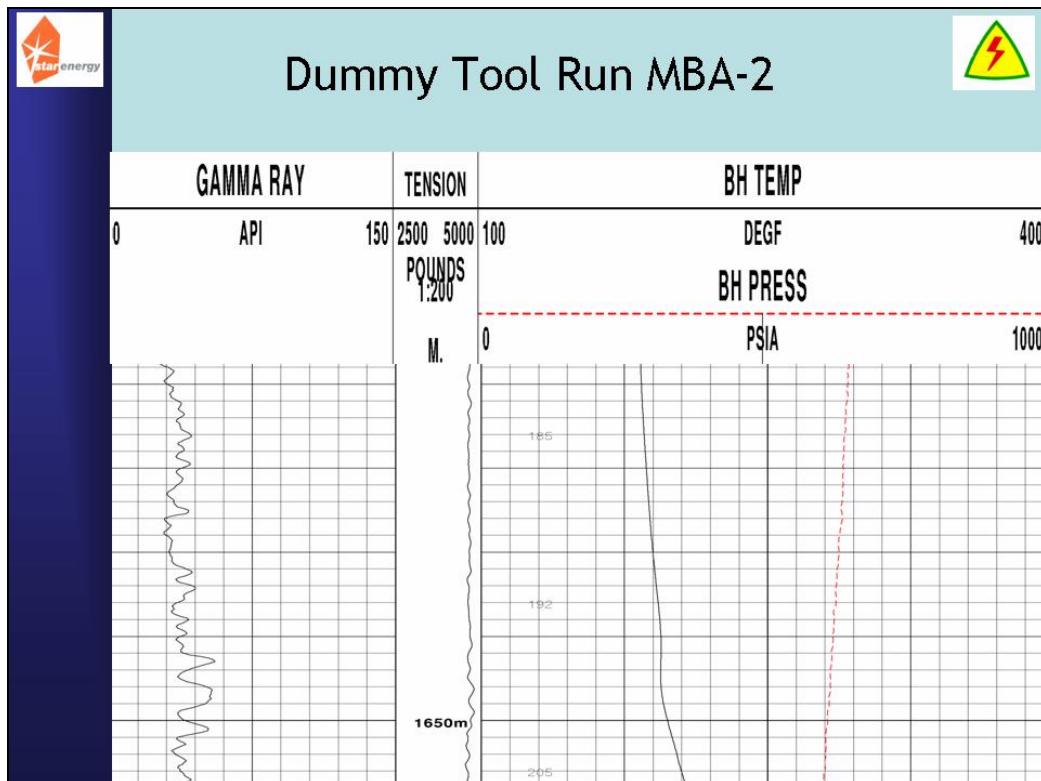
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Dummy Tool PT Run

- During dummy tool run – pressure and temperature during injection
- Steps in the temperature profile indicate permeable zones, although these can be obscured at high flow rates
- Tension on line indicates tight spots

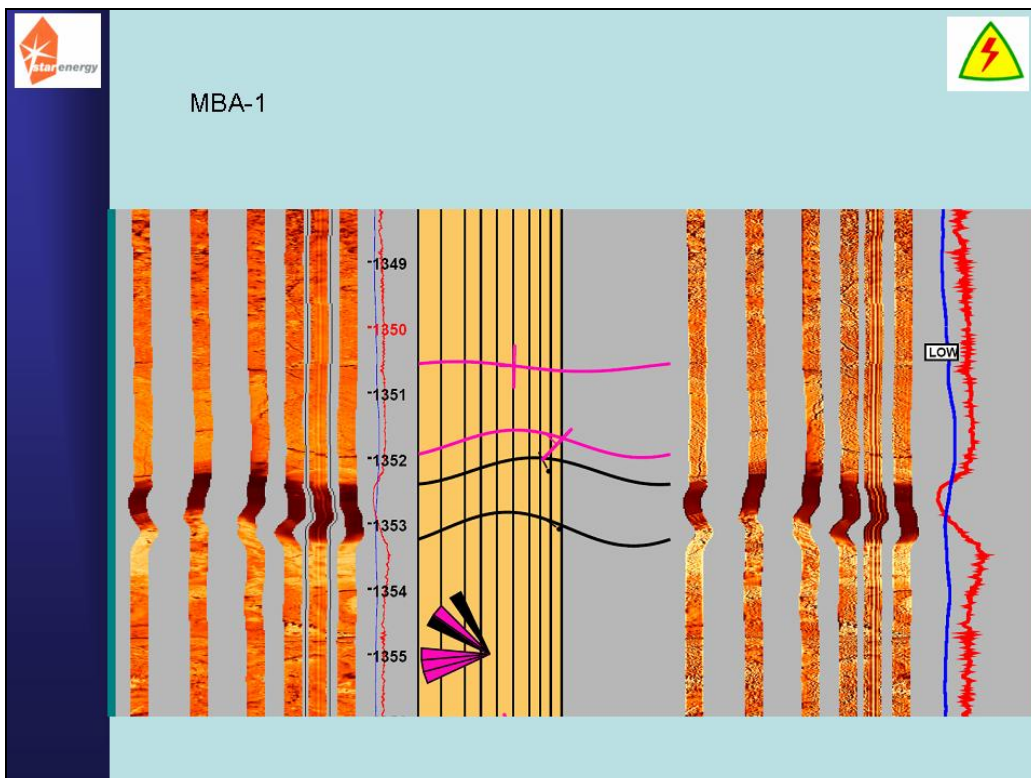





Gamma Ray

- Total gamma ray used in combination with the resistivity image can indicate the nature of the alteration, providing that variations in bore diameter are accounted for.

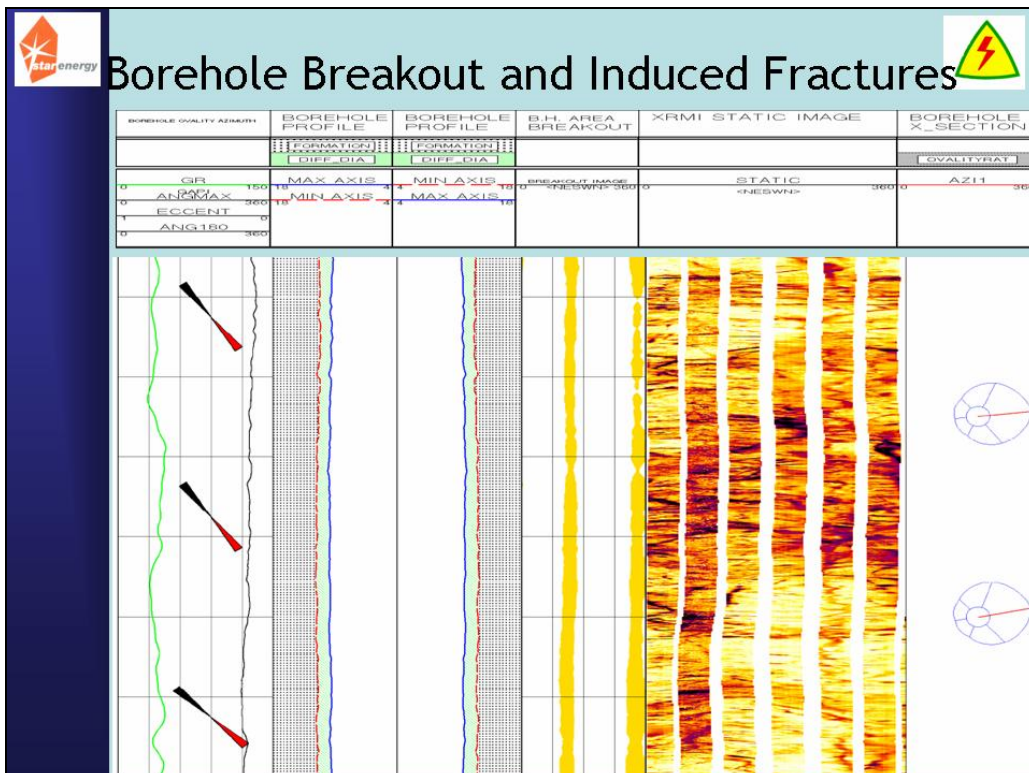
	Low resistivity	High Resistivity
Low gamma	Smectite-rich	Silicification
High gamma	Illite-rich	Adularia-rich





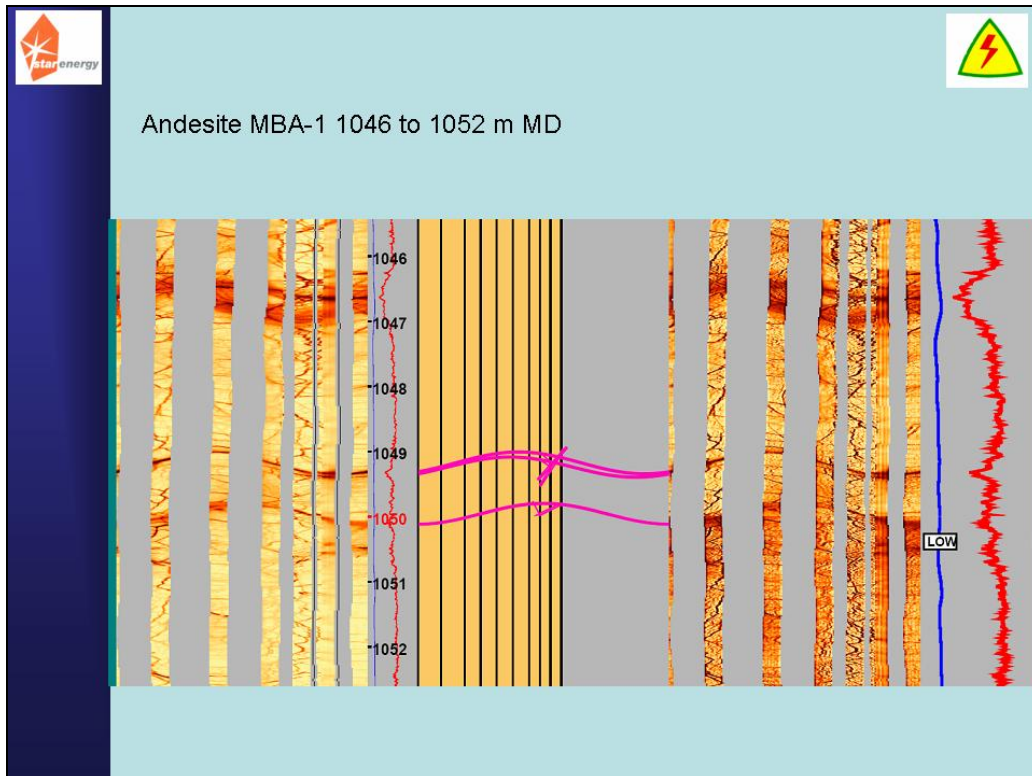

Survey and Calliper Logs

- A continuous set of declination and azimuth data is generated by the tool
- A full calliper log is obtained





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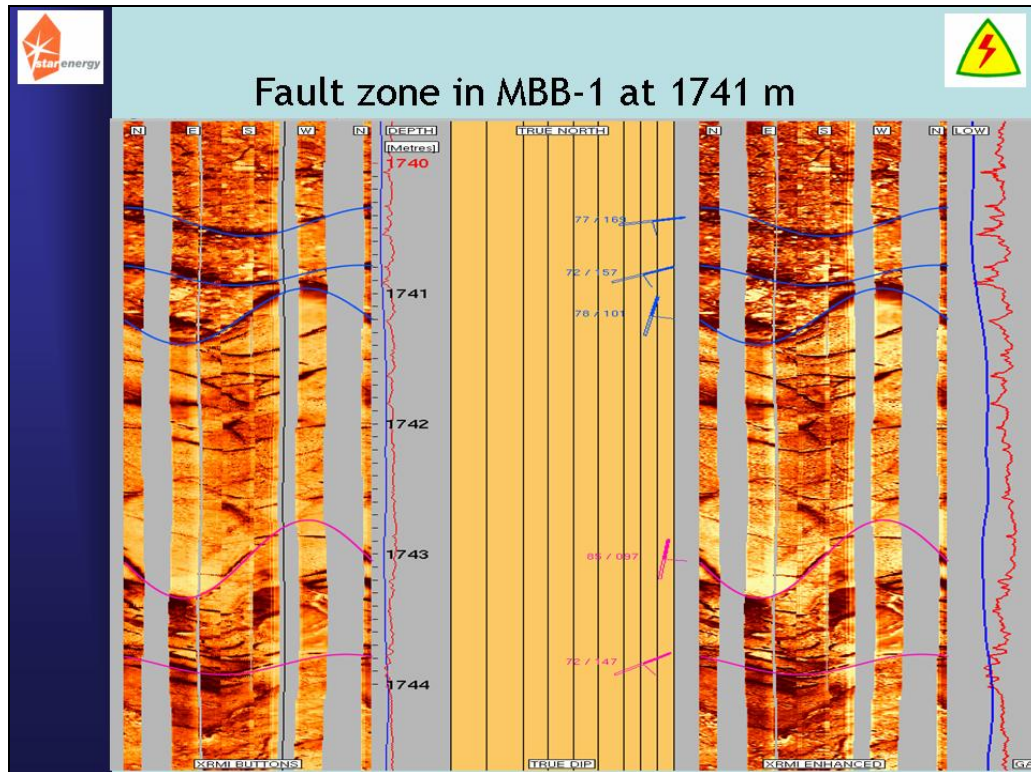


Lithology

- Lithologies can be interpreted from joint patterns or clast outlines providing that alteration is not texturally destructive



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Alteration

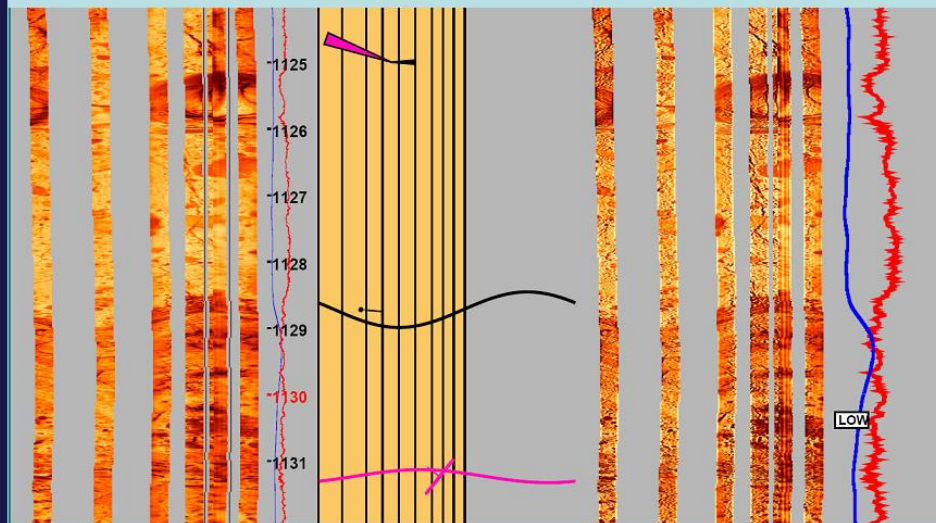
- Clay rich alteration zones can be clearly identified
- Some information on intensity of alteration can be obtained on alteration resistant rocks
- Using both gamma and resistivity some mineralogical interpretations can be made



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Bedding

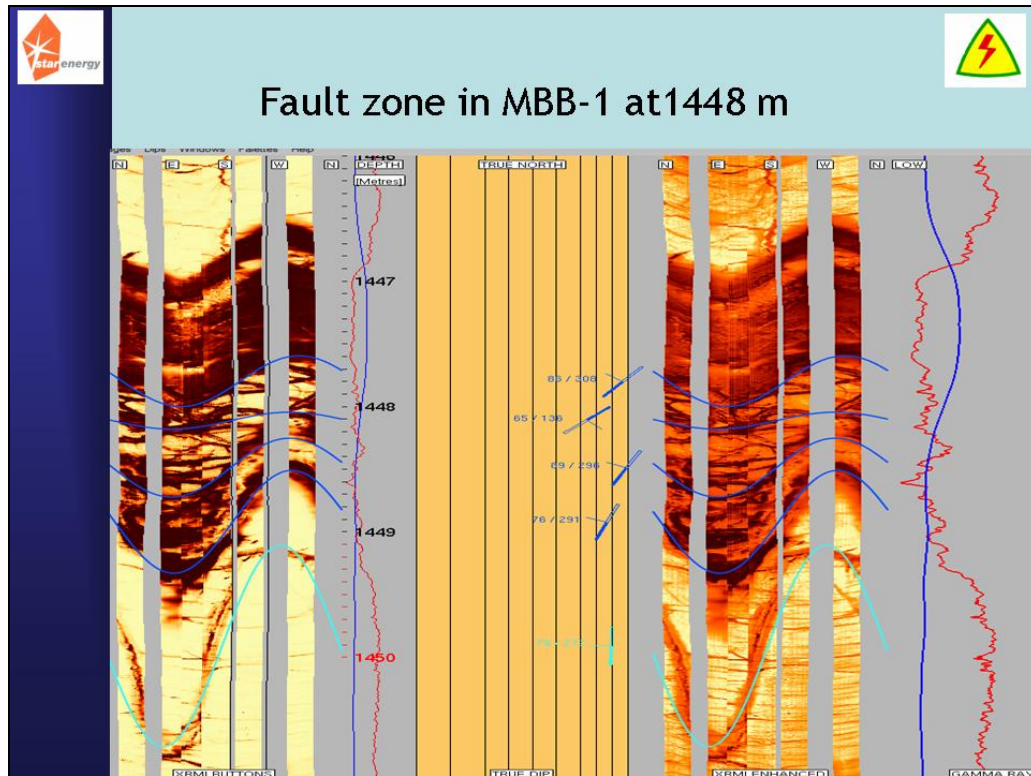


Faults

- Clearly identified where there are lithological offsets and shear zones
- Hard to establish relative movement on fractures otherwise



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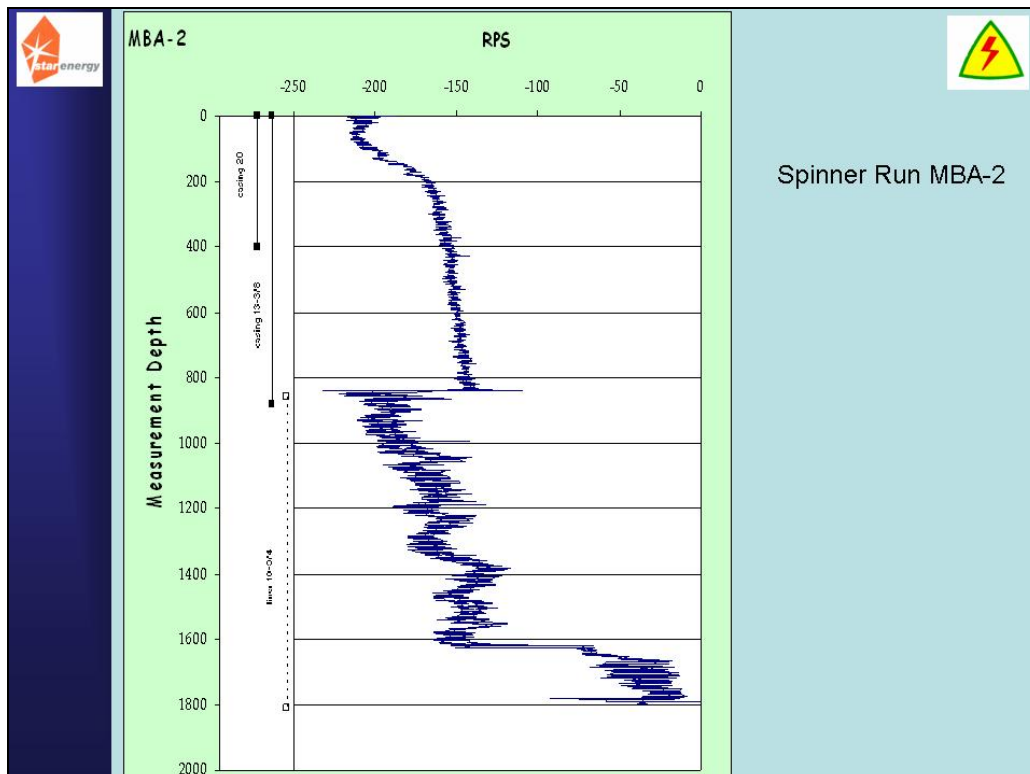
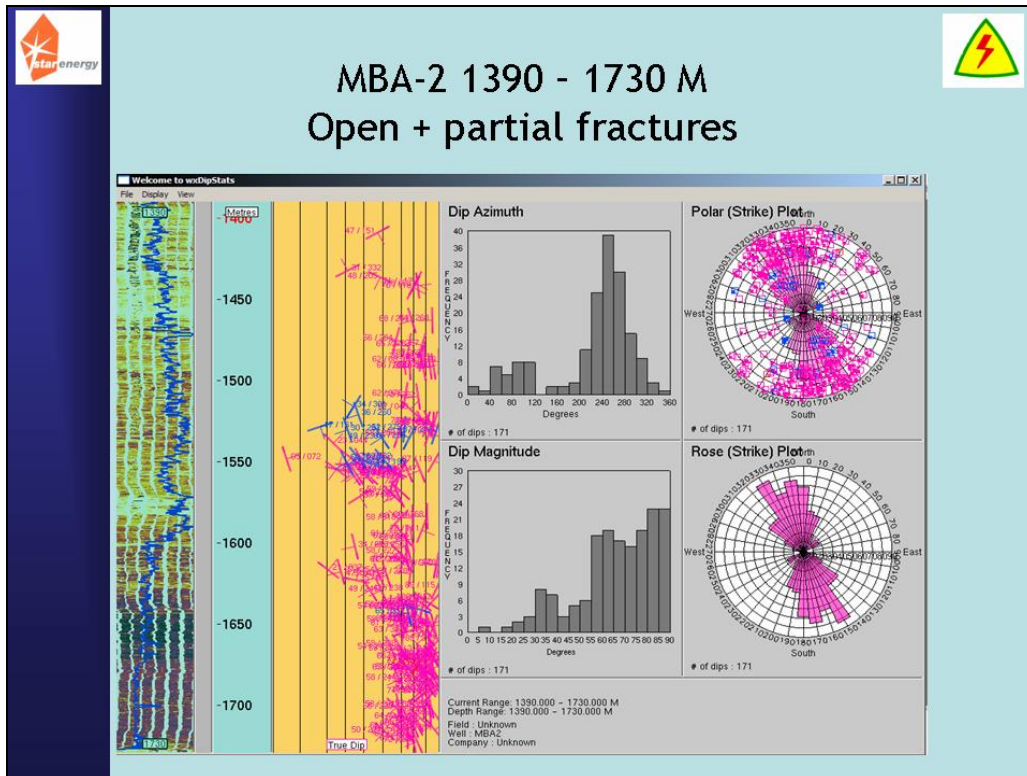


Fractures

- Some fractures may be faults
- Fractures can be sealed and are thus veins



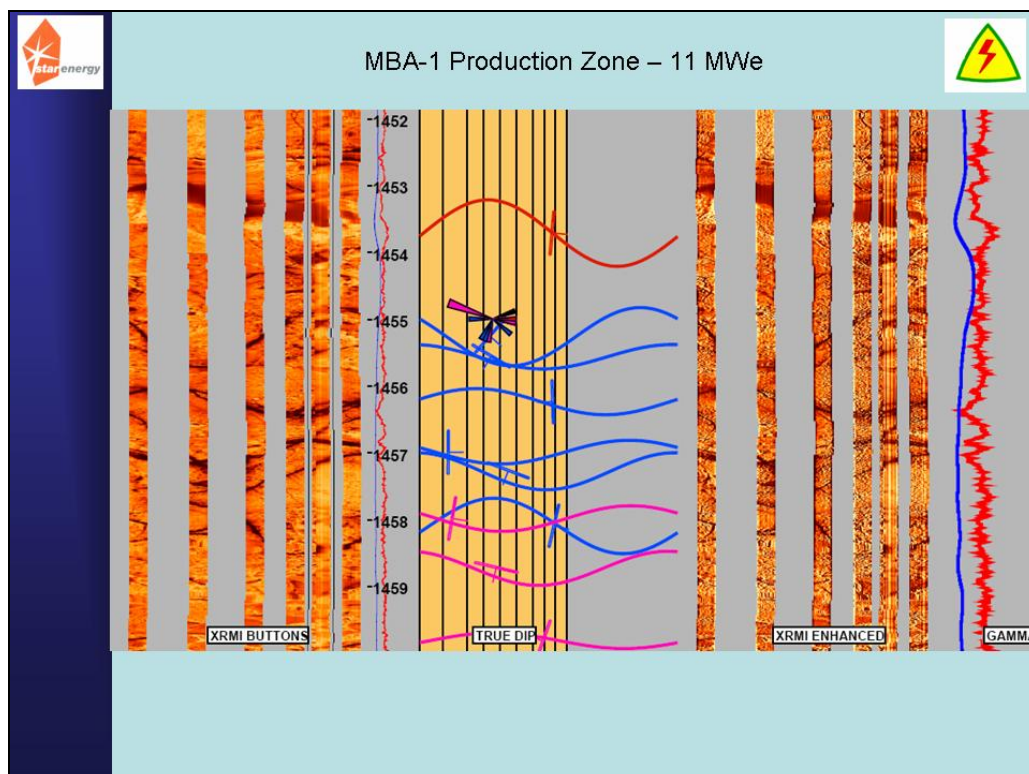
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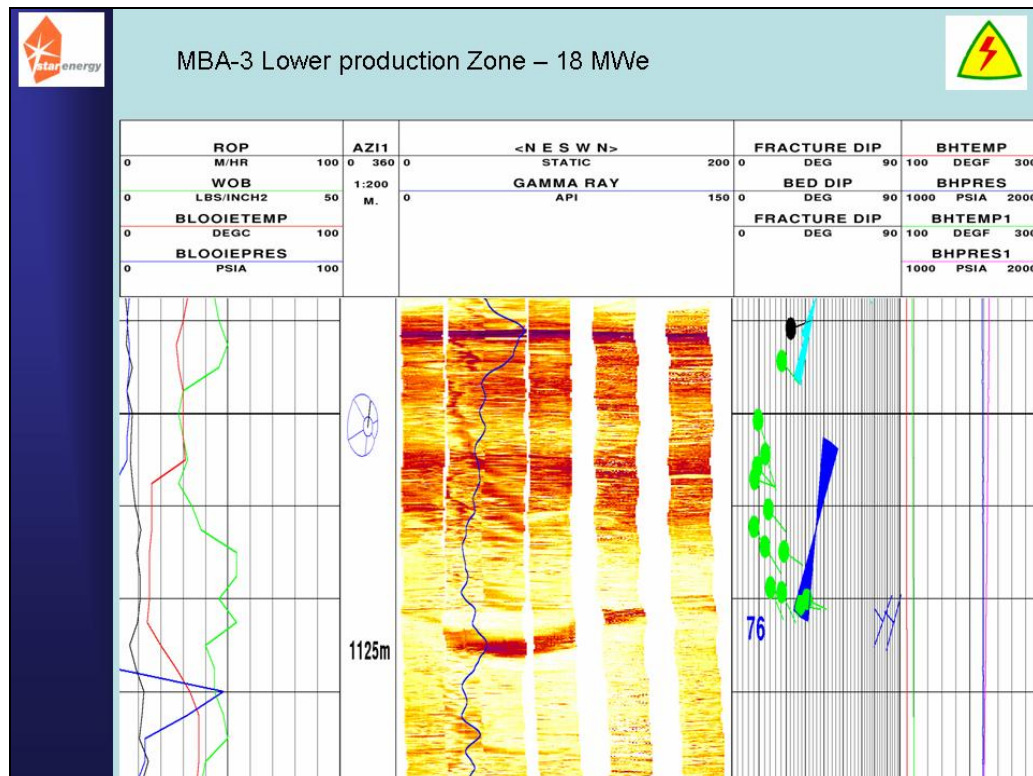
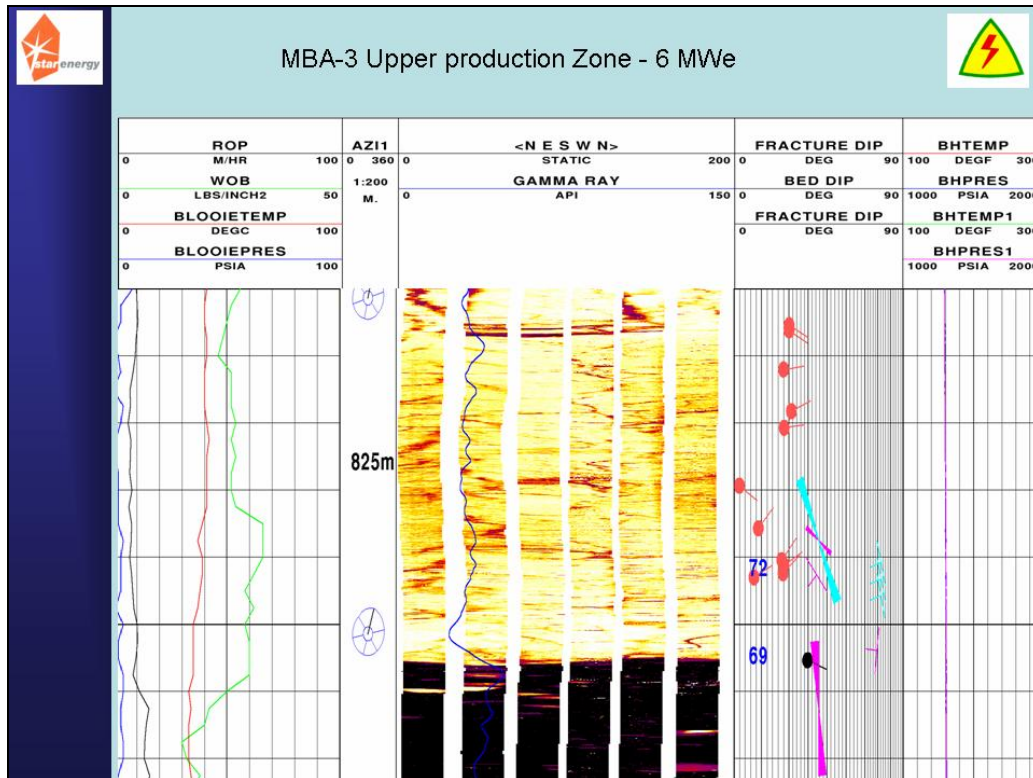

Production Zones

- These can not be directly identified by XRFM as it does not provide information regarding pressure relationships within the reservoir
- Productive zones have to be identified by spinner runs



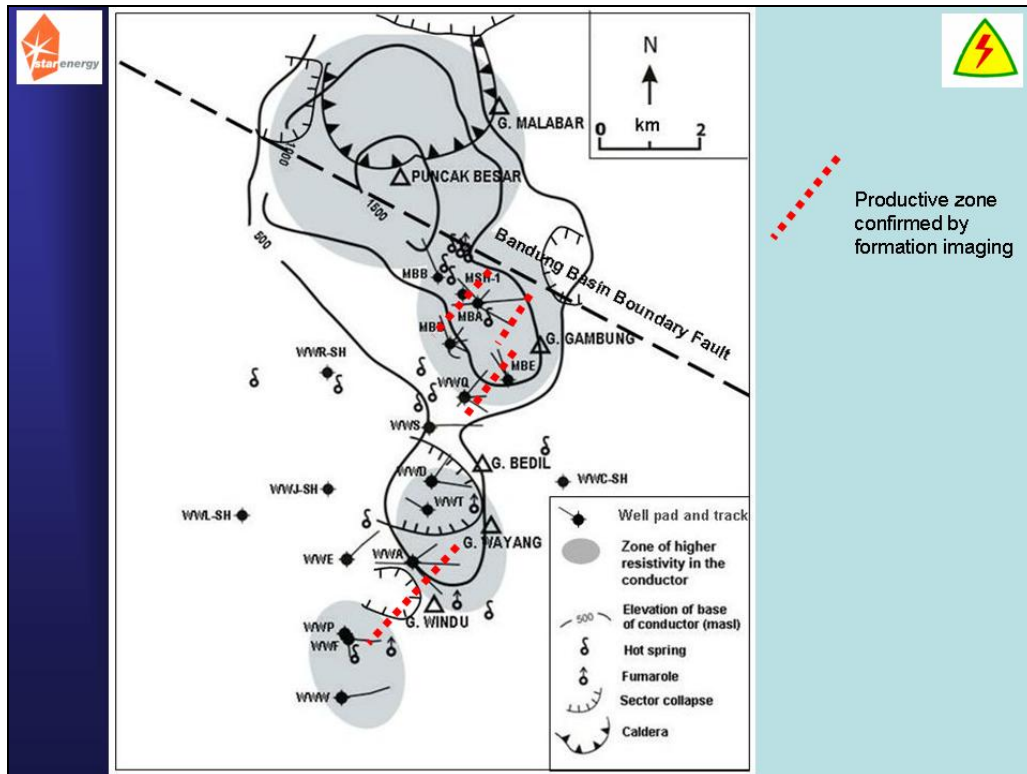


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Summary and Conclusions

- Formation imaging produces a wide range of comprehensive information
- If runs at the right depth intervals can be obtained the orientation of productive zones can be established
- Extensions of these zones can then be accurately targeted