



भारतीय प्रौद्योगिकी
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धनबाद

IIT
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**INDIAN INSTITUTE
OF TECHNOLOGY**
(INDIAN SCHOOL OF MINES)
DHANBAD

GPC510 - Well logging

Semester - Winter 2023; Case study

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PROBLEMS TO BE SOLVED

1. Propose necessary instrumentation requirements to design a gamma ray tool if the department wants to build one.
2. Perform quality control of wireline logs and marked obvious outlier in the basic well logs.
3. Calculate total porosity from the density and neutron combination and mark the zone with the highest porosity.
4. Plot velocity depth profile (compressional and shear) colour coded with Volume of shale.
5. Calculate water saturation (S_w) with Archie's method and generate a reservoir flag where the volume of shale, $V_{sh} \leq 0.4$ and $S_w \leq 0.7$.
6. Report total porosity, water saturation, and V_{sh} with a standard deviation of the reservoir zone.

STRATIGRAPHY

TIMESCALE			DUNIFLAGELLATE ZONE (Helby et al, 1987, Helby et al, 2004,)	STRATIGRAPHY	LITHOLOGY sandstone mudstone volcanics   	Systems tract (Marshall & Lang, 2013)			
CRETACEOUS	Early	Hauterivian	<i>M.australis</i>	Echuca Shoals Fm. (upper)		K30			
			<i>M.testudinaria</i>	Echuca Shoals Fm. (lower)		K20			
			<i>P.burugeri</i>						
			<i>S.tabulata</i>						
		Valanginian	<i>S.areolata</i>						
			<i>E.torynum</i>						
		Berriasian	<i>B.reticulatum</i>	Upper Vulcan Fm.	UVF Mbr 3		K10		
			<i>D.lobispinosum</i>						
			<i>C.delicata</i>						
			<i>K.wisemaniae</i>					BREWSTER MEMBER	Upper sandstone Mudstone Break Lower sandstone
			<i>P.iehienne</i>					UVF Mbr 1	
			<i>D.jurassicum</i> <i>O.montgomeryi</i> <i>C.perforans</i>					UVF Mbr 0	
		JURASSIC	Late	Tithonian	<i>D.swanense</i>	Lower Vulcan Fm.		J40	
					<i>W. clathrata</i>				
<i>W. spectabilis</i>									
Kimmeridgian					J30				

HOW TO IDENTIFY OUTLIERS

- Identify basic logs required for the case study
- Plot histogram and pair-plot diagram
- Generate bad hole flag based on bit size and caliper log response

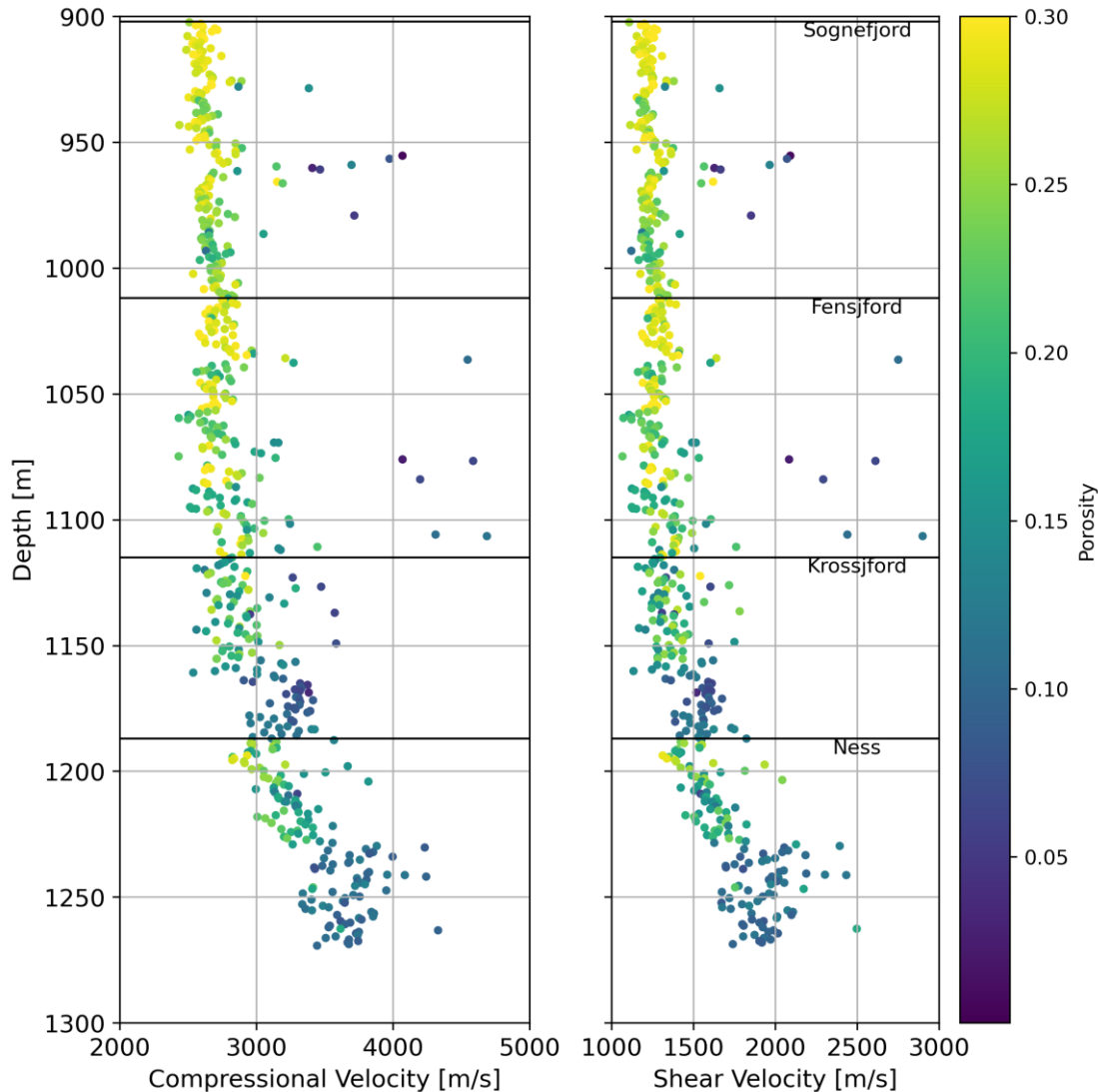
TOTAL POROSITY

- Use density log to compute density porosity (require matrix density, fluid density)
- Combine neutron and density porosity to get total porosity
- No shale correction is required

VELOCITY (COMPRESSIONAL AND SHEAR)

- Use compressional sonic DT and shear sonic log DTS to derive corresponding compressional velocity V_p and shear wave velocity V_s
- $VELOCITY (m/s) = 304800/DT$ if DT is in us/ft unit
- Generation depth profile of V_p and V_s colour coded with total porosity

VELOCITY PLOT



- Plot of V_p and V_s colour coded with total porosity.
- You need to mark the zone with highest porosity

WATER SATURATION AND RESERVOIR FLAG

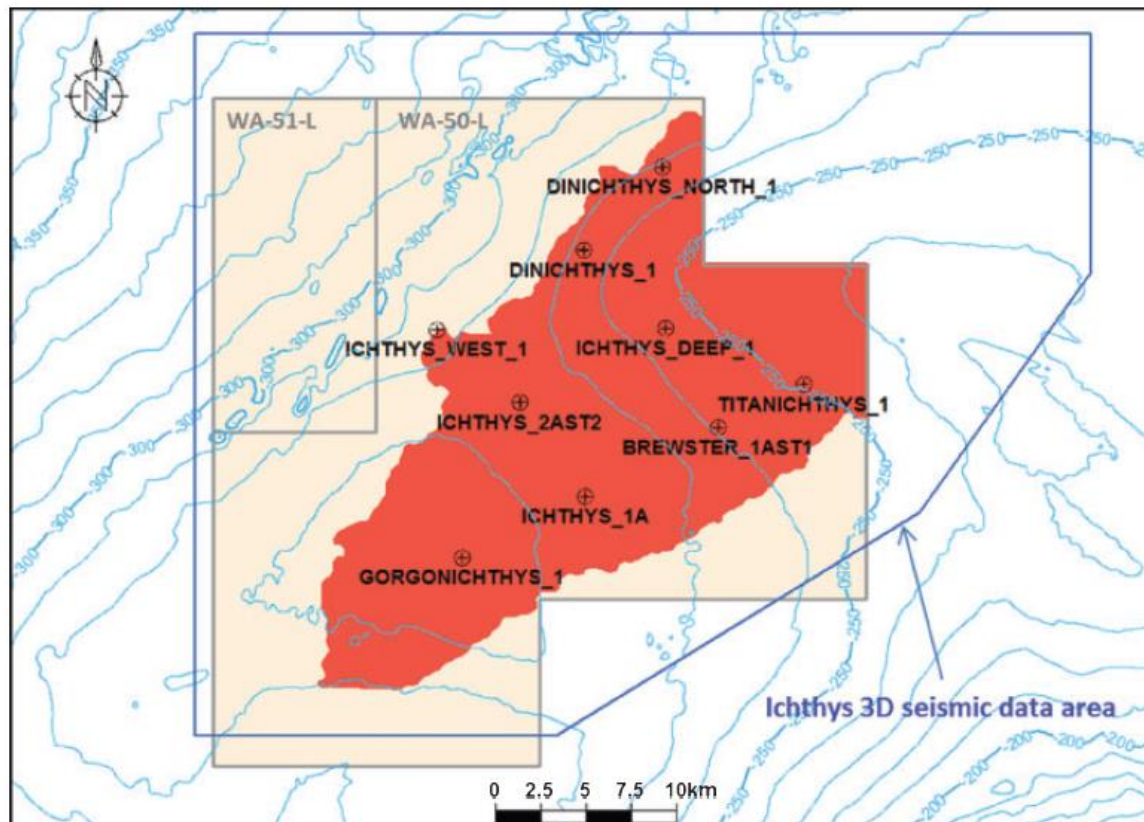
- Use Archie's equation to derive water saturation S_w . List known parameters
- What are the unknown parameters?
- Create reservoir flag with an if-else condition where
If $V_{sh} \leq 0.4$ and $S_w \leq 0.7$, $Res_Flag = 1$, else 0

STATISTICS OF RESERVOIR ZONE

- Create a separate dataframe where `res_flag=1` and then compute statistics of those data points along with standard deviation. You need to choose `Vsh`, porosity, and `Sw` only for the statistical analysis.

DATA FINDING AND WELL-COMPLETION REPORT

- <https://wapims.dmp.wa.gov.au/WAPIMS/>



END OF LECTURE

data collection



H_2 - CH_4 blend
Underground
Storage Reservoir



Geochemistry
analysis



DNA analysis



Subsurface
simulation
experiments

Thank you

Acid formation (H^+ , H_2S)