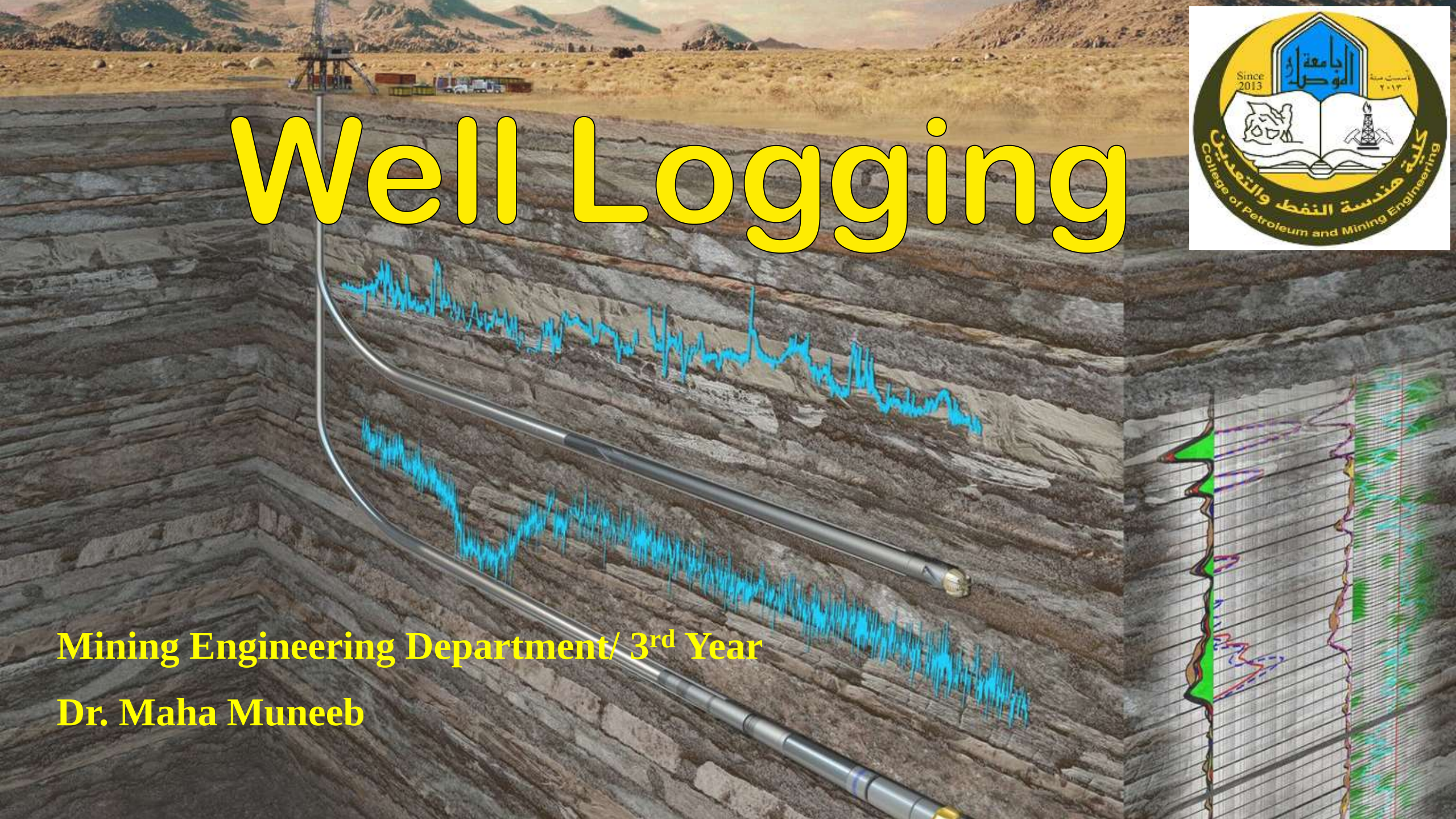
Well Logging



Mining Engineering Department/ 3rd Year

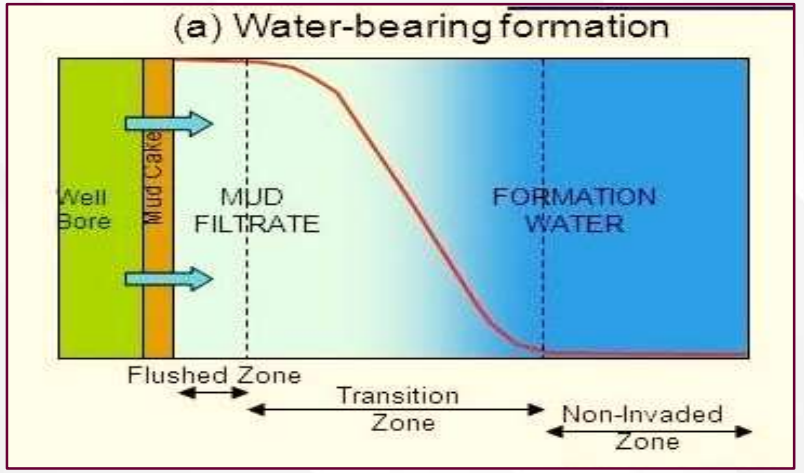
Dr. Maha Muneeb

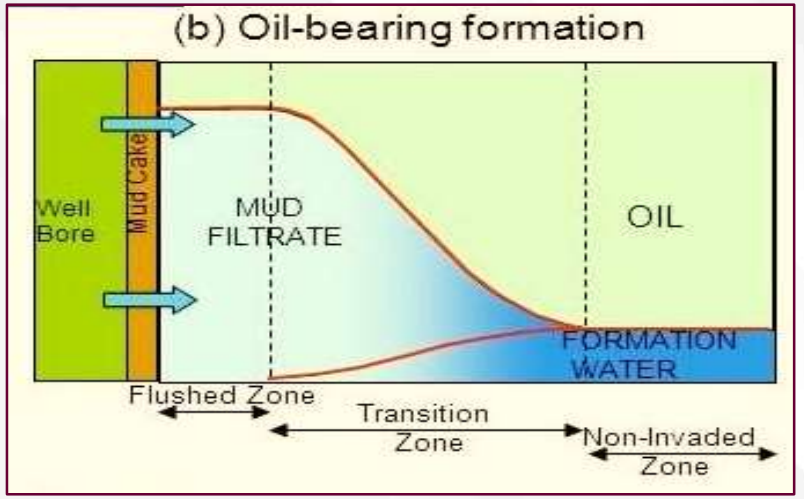
Fluid Drilling Mud

There are two main types of fluid drilling: ***Water-Based mud (WBM) and Oil-Based mud (OBM)***.

1- Invasion with Water – Based Drilling Muds

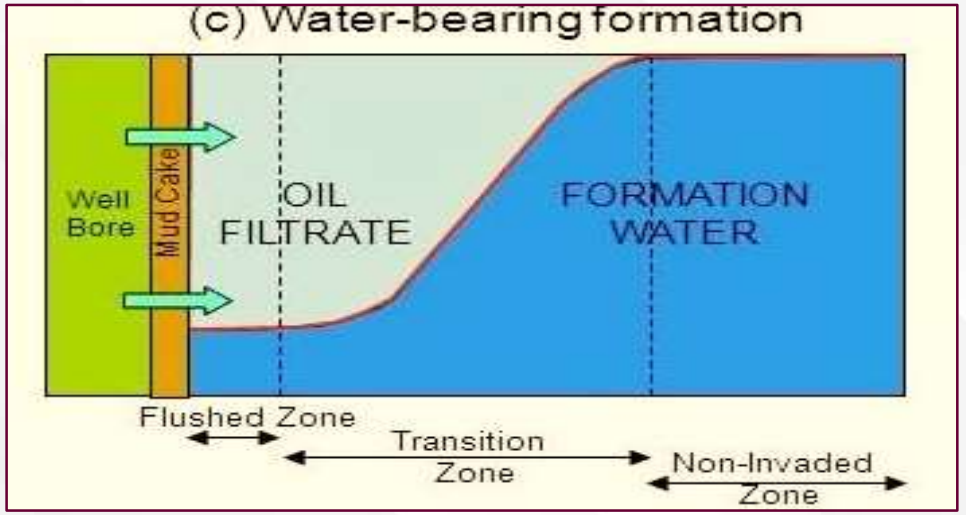
- In ***Water-Bearing Formations*****,** the mud filtrate ***replaces all*** of the formation water close to the borehole and this decrease with depth of invasion.
- In ***Oil-Bearing Formations,*** the mud filtrate ***replaces all*** the formation water and ***most of the oil*** close to the borehole wall, again decreasing with distance into the formation

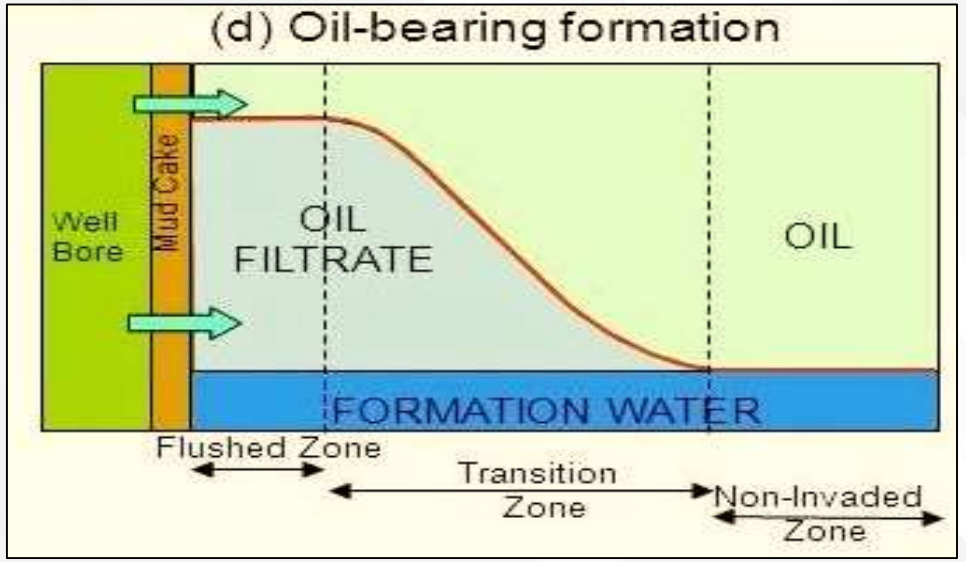




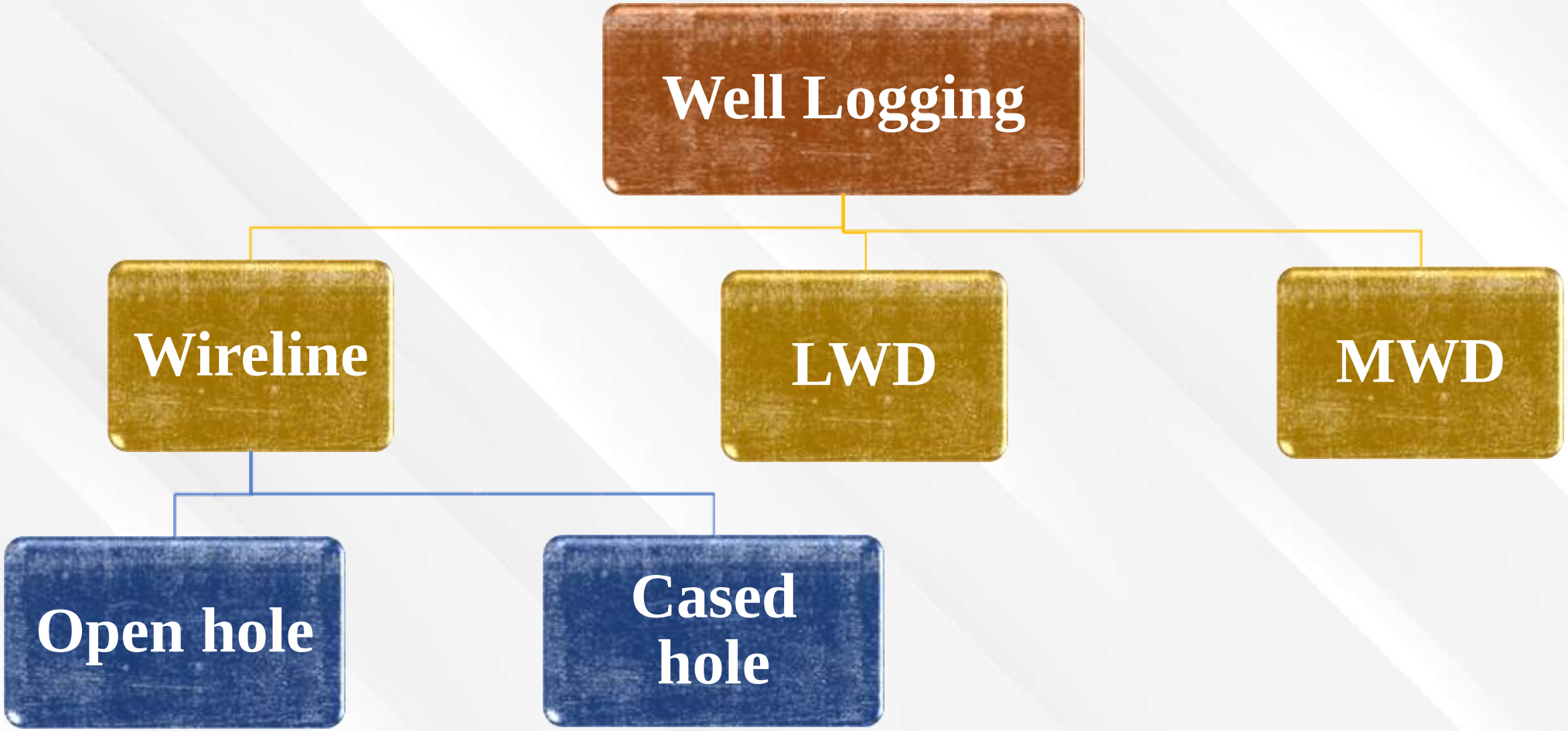
2- Invasion with Oil – Based Drilling Muds

- In ***Water-Bearing Formations,*** the oil-based mud filtrate ***does not replace*** all the formation water even close to the borehole wall.
- In ***Oil-Bearing Formations,*** the oil-based mud filtrate ***only replaces*** the oil in the formation, leaving the formation water in place.





Well-Logging Techniques:



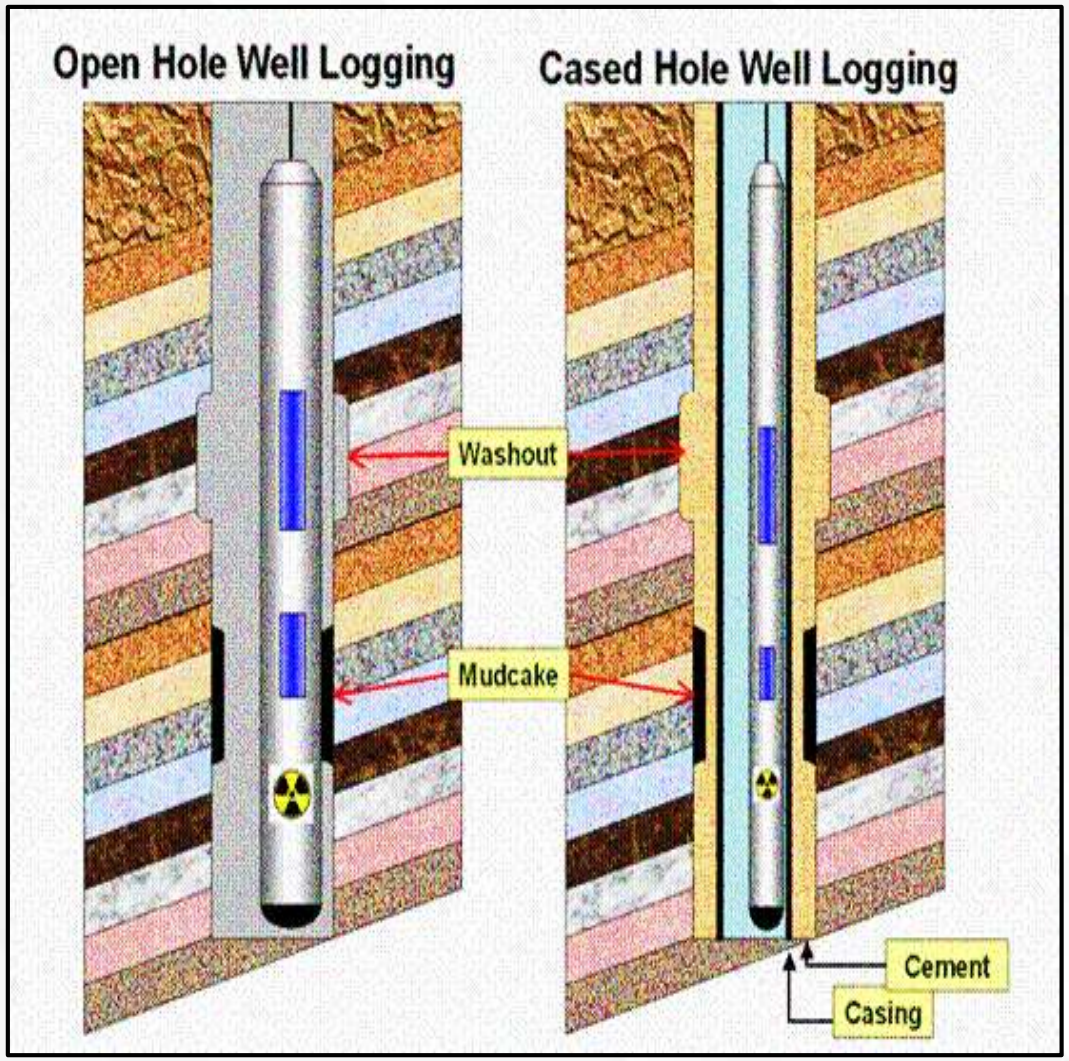
Wireline Logging

- **Open-hole logging**:

operations on a well ***before*** the wellbore has been cased and cemented.

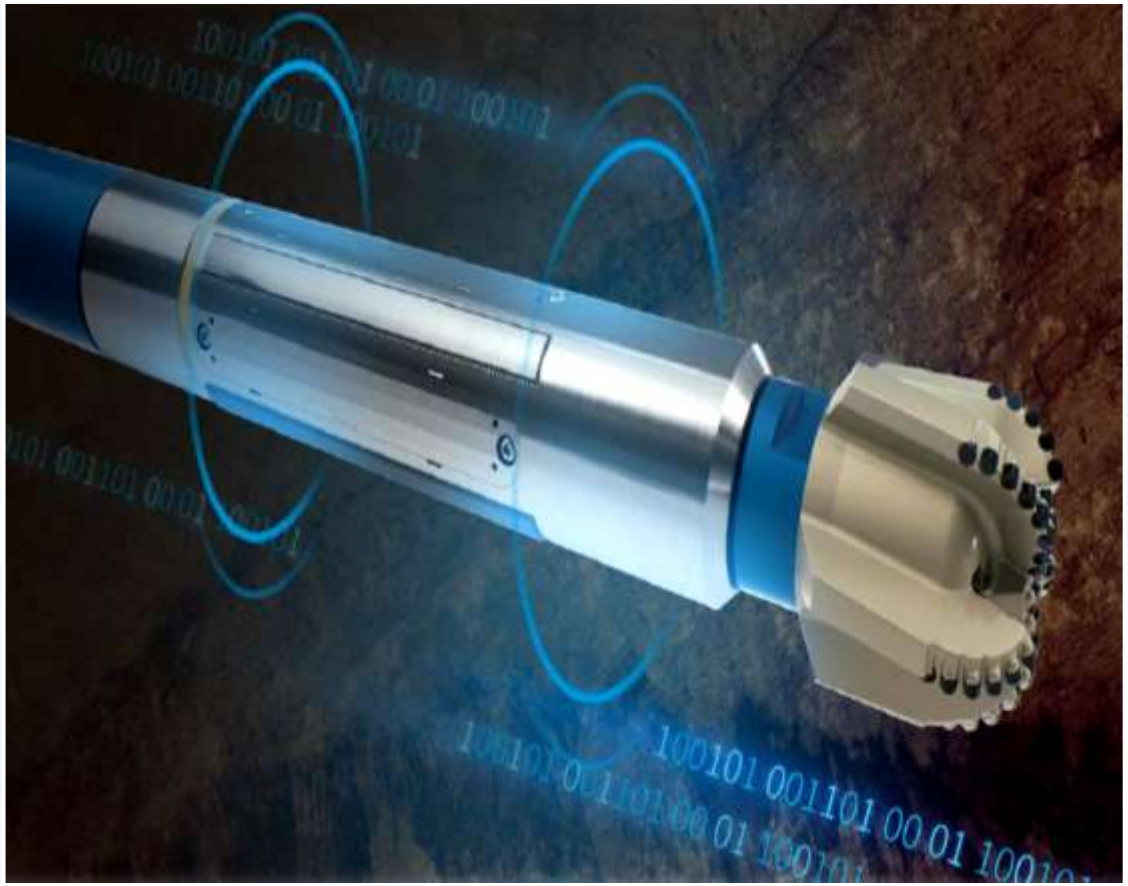
- **Cased hole logging:**

logging measurements ***through the well casing***



Logging While Drilling (LWD):

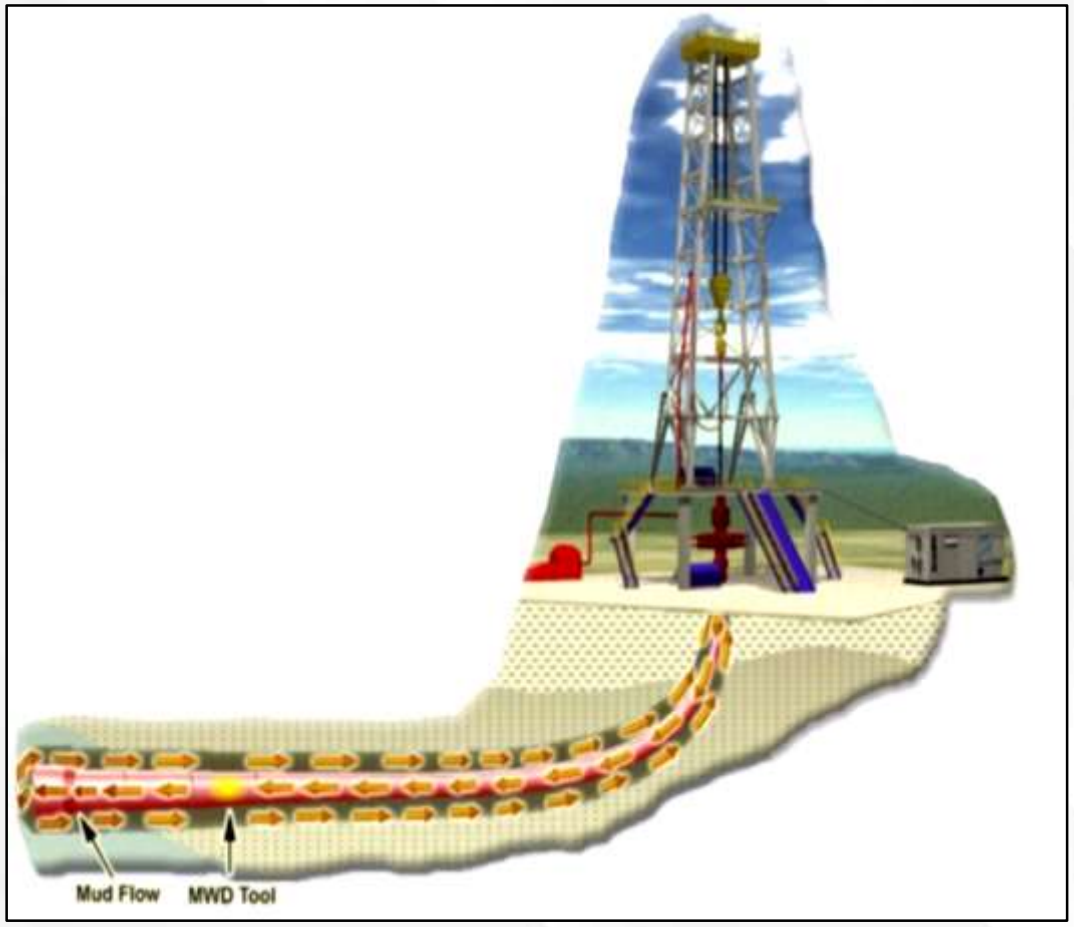
Continuous measurement taken by down-hole sensors during drilling and its measures geological parameters while the well is being drilled, particularly in offshore or horizontally drilled wells.



Measurement While -Drilling (MWD):

It’s the process by which certain information is measured near the bit and transmitted to surface without interrupting normal drilling operations.

It is including pressure, temperature, rotational speed of the drill string, mudflow volume. It is important for a safe drilling operation also in ***deviated and horizontal wells***



Why Study Well Logs (Importance of Well Logging)

1. Lithology with exact depth of formation and rock boundaries.
2. Rock properties, rock composition (mineralogy) and special interest are reservoir properties (porosity, saturation, permeability).
3. Location of fluid contacts (e.g. gas/oil, gas/water and oil/water contacts).
4. Estimate of the volume of hydrocarbon per cubic meter, and type of this hydrocarbon.
5. Identification of geological environments.
6. Identification of reservoir pressure and Porosity/pore-size distribution.

Well Logging Methods

There are many different methods of well logging that can employed for solving various problems connected with geophysical exploration.

There are **three** general types of logs:

1- Electrical

- Spontaneous potential
- Resistivity

2- Nuclear

- Gamma Ray
- Density
- Neutron

3- Acoustic

- Sonic

The Components of Well Log Paper

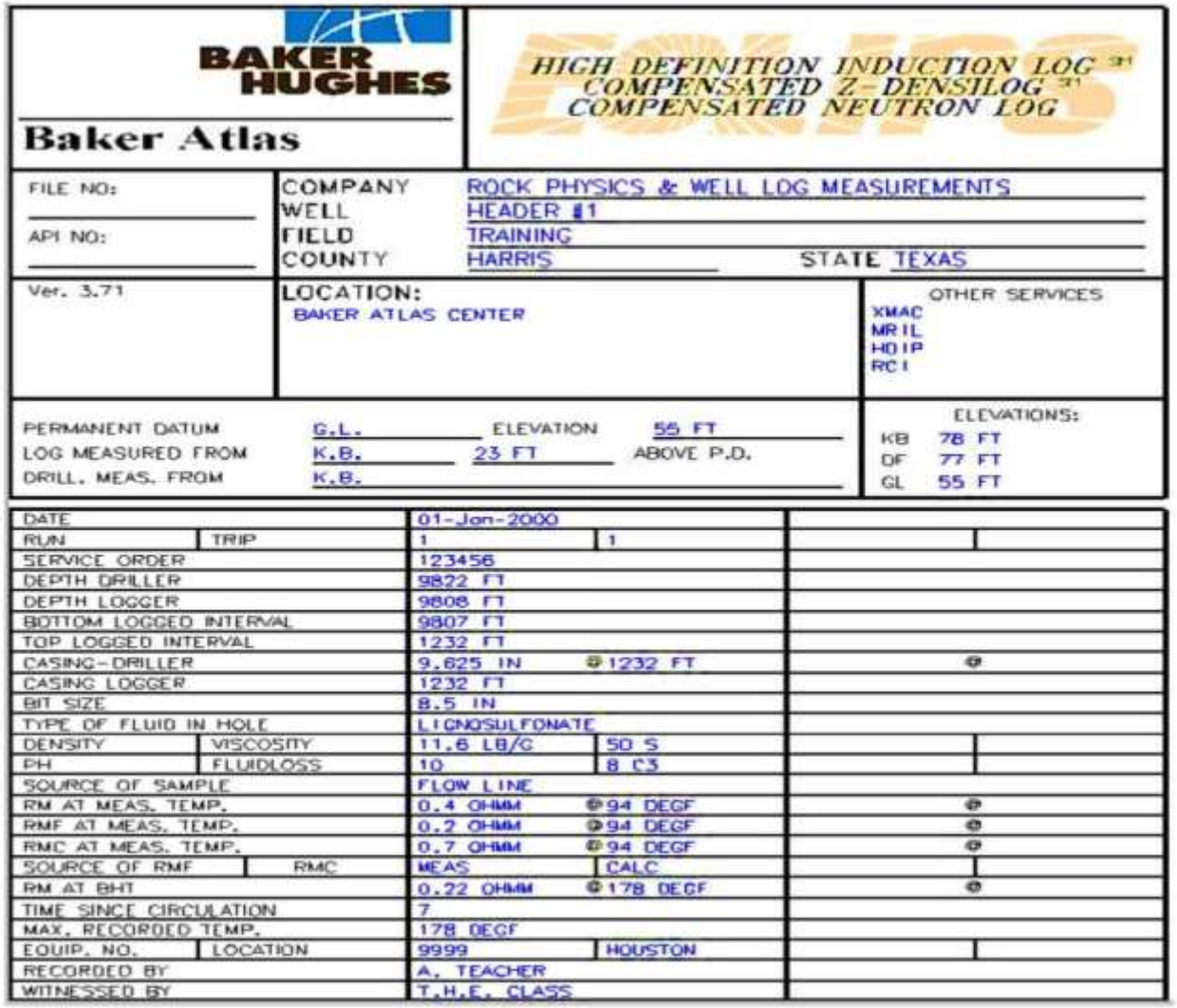
1- Log Header

- *Background well information*

- *Borehole conditions*

2- Main Log

3- Log Trailer



BAKER HUGHES

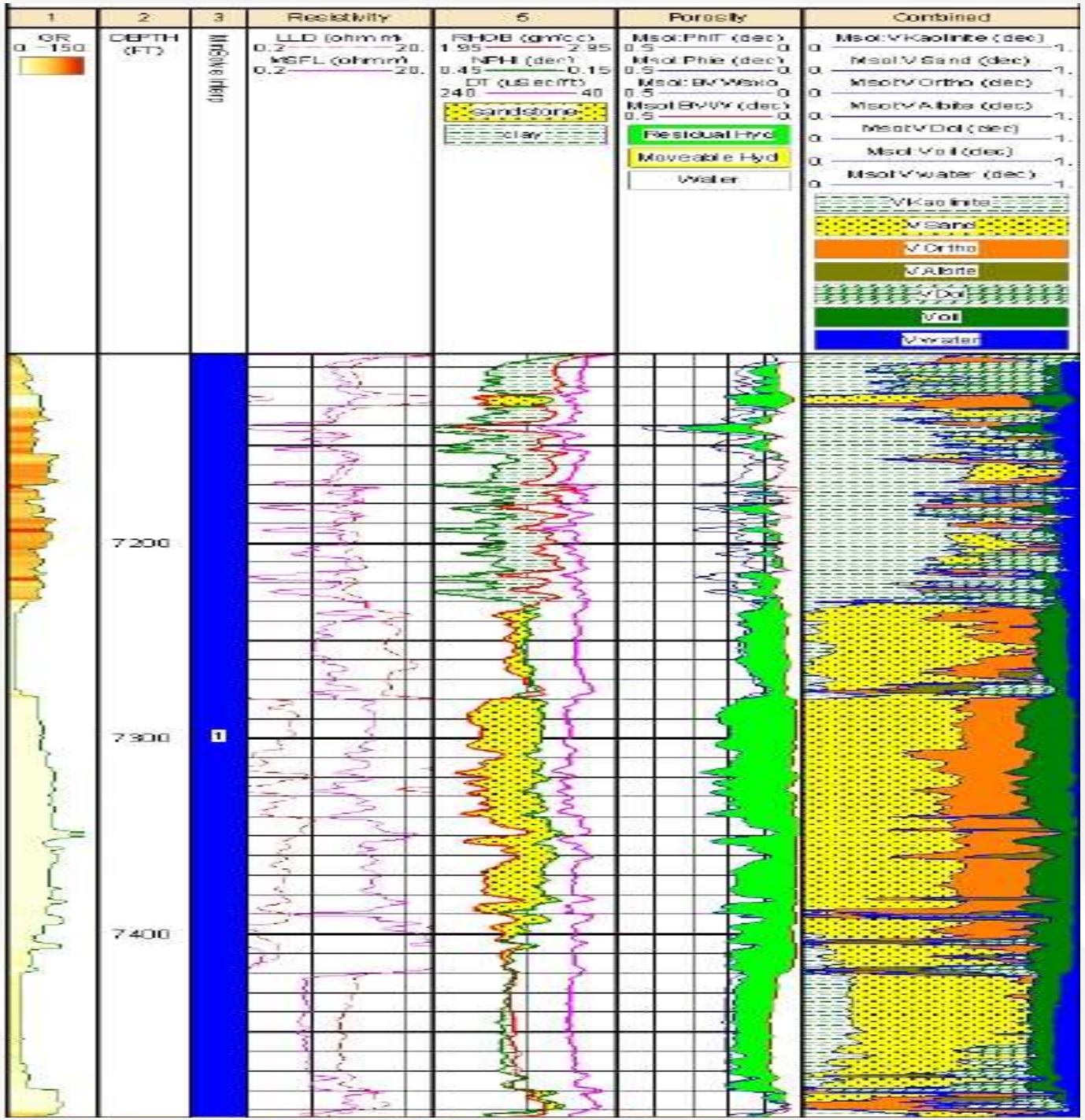
Baker Atlas

HIGH DEFINITION INDUCTION LOG
COMPENSATED Z-DENSILOG
COMPENSATED NEUTRON LOG

FILE NO:	COMPANY	ROCK PHYSICS & WELL LOG MEASUREMENTS	
API NO:	WELL	HEADER #1	
	FIELD	TRAINING	
	COUNTY	HARRIS	STATE TEXAS
Ver. 3.71	LOCATION: BAKER ATLAS CENTER		OTHER SERVICES: XMAC, MRIL, HDIP, RCI
PERMANENT DATUM	G.L.	ELEVATION 55 FT	ELEVATIONS: KB 78 FT
LOG MEASURED FROM	K.B.	23 FT ABOVE P.D.	DF 77 FT
DRILL. MEAS. FROM	K.B.		GL 55 FT

DATE		01-Jan-2000			
RUN	TRIP	1	1		
SERVICE ORDER		123456			
DEPTH DRILLER		9822 FT			
DEPTH LOGGER		9808 FT			
BOTTOM LOGGED INTERVAL		9807 FT			
TOP LOGGED INTERVAL		1232 FT			
CASING-DRILLER		9.625 IN	@1232 FT		@
CASING LOGGER		1232 FT			
BIT SIZE		8.5 IN			
TYPE OF FLUID IN HOLE		LIGNOSULFONATE			
DENSITY	VISCOSITY	11.6 LB/G	50 S		
PH	FLUIDLOSS	10	8 C3		
SOURCE OF SAMPLE		FLOW LINE			
RM AT MEAS. TEMP.		0.4 OHMM	@94 DEGF		@
RMF AT MEAS. TEMP.		0.2 OHMM	@94 DEGF		@
RMC AT MEAS. TEMP.		0.7 OHMM	@94 DEGF		@
SOURCE OF RMF	RMC	MEAS	CALC		
RM AT BHT		0.22 OHMM	@178 DEGF		@
TIME SINCE CIRCULATION		7			
MAX. RECORDED TEMP.		178 DEGF			
EQUIP. NO.	LOCATION	9999	HOUSTON		
RECORDED BY		A. TEACHER			
WITNESSED BY		T.H.E. CLASS			

Figure 3-3: Log header (example), Baker Atlas.


1
2
3
Resistivity
5
Porosity
Combined
GR
0 150
DEPTH
(FT)
Interpretation
LLD (ohmm)
0.2 20.
MSFL (ohmm)
0.2 20.
RHOB (gm/cc)
1.95 2.95
NPH (dec)
0.45 -0.15
DT (uSec/ft)
240 40
sandstone
clay
Msol:PhiT (dec)
0.5 0
Msol Phie (dec)
0.5 0
Msol:BVWsxo
0.5 0
Msol BVW (dec)
0.5 0
Residual Hyd
Moveable Hyd
Water
Msol:VKaolinite (dec)
Msol V Sand (dec)
Msol V Ortho (dec)
Msol V Albite (dec)
Msol V Dol (dec)
Msol Vol (dec)
Msol V water (dec)
VKaolinite
V Sand
V Ortho
V Albite
V Dol
Vol
V water
7200
7300
7400
1

Thank You!