

Coal Exercise

Exercise 7: A lithological interpretation of coal and its related sedimentary environment with the aid of logging tools.

Educational targets: An uncomplicated evaluation of several coal seams and related sediments with the results of the natural gamma-ray log, sonic log, neutron-neutron log, and density tool.

Case story:

Due to the lack of "strong" foreign currencies in the Eastern European Countries, the amount of oil and gas, as a major part of the energy supply, is slowly declining. These countries are searching for alternative national energy sources and new ways of energy production. The Nazdrave-coal fields near Rila (Bulgaria) are situated at shallow depths. The area is well known of its relatively small coal fields and thin coal seams. The conventional mining methods are environmentally unacceptable and very expensive.

Therefore the Board of the mines decided to investigate alternative coal and energy production methods such as Underground Coal Gasification (UCG) and Coalbed Methane Exploitation (CBM). On the basis of an available exploration well a target area is appraised on its vertical quality. For both methods the thickness of the coal seams (at least 1.5 m) and the sealing quality of overlying strata (claystones or shales) are of major importance.

The following laboratory analysis are known from the exploratory well:

- Several coal seams have been identified.
- The main seam was cored and analyzed on densities:

ρ_{carb}	= 1.20 g/cc)	T_{carb}	= 135 s/ft
ρ_{ash}	= 2.55 g/cc)	T_{ash}	= 80 s/ft
ρ_{mois}	= 1.02 g/cc)	T_{mois}	= 190 s/ft

General questions:

- What are the horizontal and vertical resolutions of the available tools. (Syllabus)
- Give an interpretation of the lithology between 160 m and 215 m, using the gamma ray, sonic and density tools. Square the gamma ray to define layer thicknesses.

The following symbols can be used:

::::: Sandstone/siltstone

||||| Carbonaceous claystones

— _ — _ Claystone/shale

■ Coal

Questions regarding coal:

- Define the thicknesses of the different coal seams.
- Use figure 2 to define the coal type and ash content. Are the results relevant?
- Calculate the volumes for moisture, ash and coal, based on on the mentioned densities and transit times with the equations 9.2 a,b and c (lecture notes)

Questions regarding overburden:

- Use the Gamma ray to define the shale line and sand line.
- Define the shale volumes for the layers in the zone between 160 and 180 m with the GR-shale equation.
- The clean sands in this section show an increasing transit time. What are the porosities when a $S_w=1$ is considered? (use the bulk density, $\rho_{\text{mois}}=1.02$ g/cc and $\rho_{\text{matrix}}= 2.68$ g/cc).

Conclusive question:

- Which coal seam can be used for UCG or CBM?

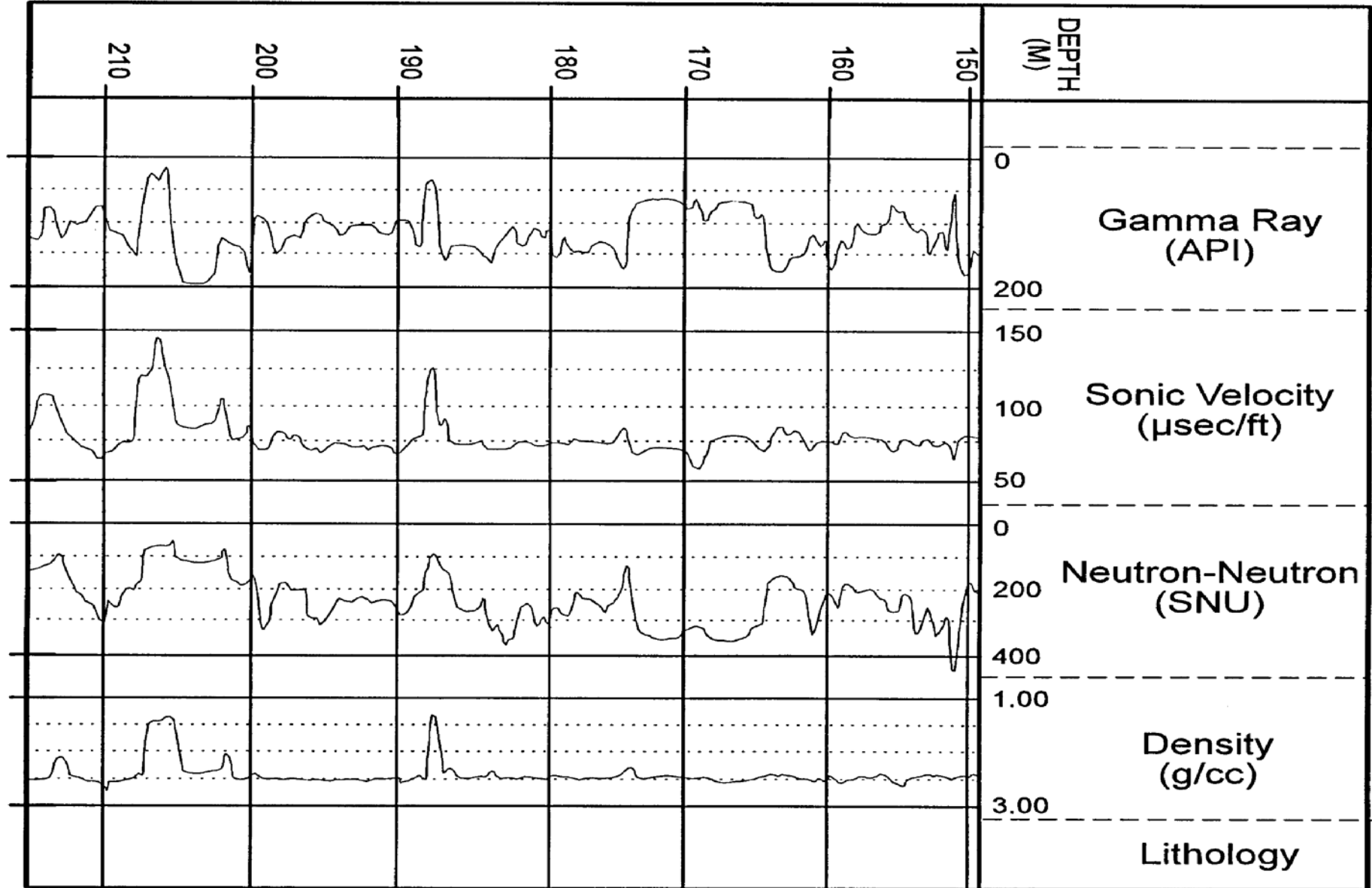


FIGURE 2: COAL DENSITY VS ASH CONTENT

