Dikirnis wells Project

Comments and recommendations

The results of this project are of real importance to geophysical/geological exploration for oil and gas. The Adrok ADR E log (logarithmic scale) can be correlated with remarkable accuracy to the nearly drilled E- Dikirnis - 1 well. The E log found the top of the Qawasim SS at correct depth, the formation thickness was also accurate and the majority of other sandstones in the drilled well could be closely matched by corresponding peaks on the E log. Limestones (not noted by the client) were found at depths matching those on the mud log of the E- Dikirnis - 1 well.

These results are quite remarkably accurate and unequalled by any other system.

Accurate prediction of depths to particular rock formations and their thickness would be the main interest of any oil company client. An additional interest would be of the Adrok dielectric contact log could indicate the presence of hydrocarbons.

I would suggest that in the field Adrok might consider acquiring ADR data at more than the location near drilled well. That extra work would be of real value for producing more than one virtual well.

Jim Ward 22/06/2014

Adrok

Log Correlation of Adrok Elogs for East Dikirnis – 1 and South East Dikirnis – 1 with GR and RHOB logs of East Dikirnis

(Abbreviations: East Dikirnis -1: ED-1

South East Dikirnis: SED-1 (Sep.2011)

Qawasim Sandstone: QSS)

Objectives

This report compares the ADROK ADR Energy log (Elog) recorded at surface near to the East Dikirnis -1 (ED-1) well with the downhole wireline logs: GR and RHOB and the mudlog and computerised lithology logs of that well. The Elog has been correlated with these other logs. A correlation of the Elog for ED-1 was then made with that for the South East Dikirnis – 1 well (SED-1) and a provisional lithology for the latter well was made.

The results are summarised on three cross-sections:-

Figure 1

Log plot for ED- 1: Elog v GR log (Aug. 2011). (Note: the Elog is on a logarithmic scale)

Figure 2

Log correlation section:

Mug log, RHOB, computerised lithology, GR, Adrok Elog (arithmetic scale) (Sep. 2011)

Figure 3

Correlation section ED-1 and SED-1 (Sep. 2011)

(i) ED-1: GR v Elog
(ii) SED-1: Elog
(iii) Inferred lithology

Conclusions

Figure 1 shows good correlation between the peaks (LHS trending) of the Elog and the GR of the ED-1. In particular the depth and the thickness of the main formation: Qawasim Sandstone has been identified. The correlation allows distinction to be made between the other sandstones and

shaly lithologies. The Elog has also distinguished certain thin limestones from sandstones as confirmed by mug log.

Overall, the Elog shows good similarity to the GR log. It could therefore be used to generate a reasonably accurate lithology for the ED-1 well and also the depths to significant geological markers.

Figure 2 correlates the four ED-1 logs and the ADR E log.

Figure 3

Correlation of the Elogs for the ED-1 and SED-1. These logs could be useful for generating a theoretical lithology log SED-1.

Details PTO

Detailed descriptions of the correlations

The correlations are for depths 7200 to 8100 feet at ED1-1. Figure 1 shows depth columns of the GR log for well ED-1 compared to similar depths on the Adrok Elog recorded near to the well location. Top of QSS is at 7490 feet. The majority of peaks on the Elog that point to the LHS and also those pointing to the RHS peaks on the Elog can be matched with those of the GR log at similar depths. The share line of the sector above the QSS shows slight deviations to the RHS but these are matched by more pronounced RHS peaks on the Elog (RHS matching peaks are connected by blue lines). Below the QSS there are thin beds of shale between the sandstones down to 7750 feet. Most of these shales represented br RHS trending peaks on the GR are also matched by RHS peaks on the Elog. However in the slit and sandstone section below 7750 feet there are only a few silty shales present until the fifty foot is reached at 8025 feet. Within this silty sand section there are a few minor indications of RHS matching peaks indicating some shaliness.

Elogs peaks that point to the LHS are matched by GR peaks on the same trend representing sandstones. These sandstone correlations are shown by orange lines. A total of 23 orange and 20 blue lines representing the correlations are present within the section 7200 to 8100 feet. Some details follow:-

The section above the QSS (700 to 7400 feet) is mainly shale with 2 sands at about 200 and 300 feet above the QSS. The GR shale line is 95 to 97 API units. On the GR log the 2 sands above the QSS have peaks to the LHS at 7255 and 7305 to 7325 feet. At four other depths, very thin peaks representing sand or silt point to the LHS. The Adrok Elog ha two LHS peaks corresponding closely in depths to these two main sands and two of the thin peaks at 7350 and 7475 feet. In this shaly upper section also, there are on the GR log three thin peaks that deviate to the RHS of the shale line: at RHS peaks at closely matched depths. The RHS peak at 7375 feet shows a corresponding peak on the PHOB log but that peak points to LHS. This peak may represent a thin radioactive deposit, possibly volcanic dust that may be a useful regional horizon. This peak is called marker X. It can be seen on Tarif-1 at depth 7200.

From the QSS at 7480 down to 7800 feet there is good correlation between the position of the clean sandstones and shales on the GR, RHOB and Elog though the peaks do not all match exactly. Good correlations are present for the QSS and sands at 7575 feet and from the 7730 to 7750 feet. For the beds that are near 100% shale there is good correlation from GR to Elog, ie GR depths 7560, 7580, 7635 and 7725 feet. Depths to the corresponding RHS peaks on the Elog are close though not exactly the same.

The computer lithology log shows varying amounts of slit from 10 to 15% in the sandstones of the section below the QSS down to depth 7800. Sands with low slit content: QSS, and at depths 7575 feet and from 7725 to 7750 feet are those that give the most prominent LHS peaks on the Elog with

E values in the range 10^{-3} to 10^{-4} units. Increasing silt content appears to pull Elog peaks back towards to RHS is the shale line.

Below 7800 feet there is a large increase in silt content. From 7800 to 7825 feet silt increases further from about 20 to 60%. From 7825 to 7925 feet silt content is 20 to 30% and from 7925 to 8025 feet it is 50 to 60%. The sections: 7760 to 7825 feet and 7825 to 8025 feet are therefore interpreted as tow coarsening upwards sequences from silt to silty sandstone (cf RHOB log).

Two very sharp LHS peaks (Elog values about $10^{-5)}$ are found at 7905 and 8012 feet (Elog). There are interpreted as limestone beds based on data from the mud log records. The mud log of ED-1 has limestone beds at depths:-

7890 to 7900 feet

7943 to 7950 feet

7952 to 7967 feet

7969 to 7972 feet

7984 to 7990 feet

8010 to 8013 feet

8030 to 8032 feet

On the Elog in addition to the peaks at 7905 and 8012 feet there are several more LHS peaks that may also be limestones eg:-

7950

4967

8030

and 8074, the latter two being the fifty foot shale.

Two thin dolomite beds were recorded on the mud log of ED-1 at 7419 to 7420 feet and at 7438 to 7439 feet. These may be represented on the Elog at those depths by two depths by two minor LHS trending peaks.

In summary, at ED-1 the comparison between the Elog and the GR and RHOSB logs suggests that the Elog is mimicking the GR and to some extent the RHOB log. The evidence is that there is good correlation of the cleanest sandstones from Elog to GR and RHOB as shown sharp Elog LHS peaks of 10^{-3} to 10^{-4} units. Where sands become silty the peaks are dampened to the RHS. The cleanest shales (100% scale) on the other hand give good correlation from Rlg to GR log with peaks to the RHS with values of 10^{-1} to 10^{-0} units. Limestones are not interpreted on the computer lithology. But sharp LHS peaks with values of 10^{-5} to 10^{4} occur within the zone where the mud log shows limestones and are therefore interpreted as such.

Adrok Virtual Lithology log for well South East Dikirnis-1 (SED-1)

The Adrok Elog for SED-1 can be correlated at a number of horizons with the Elog of ED-1. Good matches are found at the following horizons:-

	Depths (feet)	
	ED1	SED1
Marker X (above QSS)	7375	7080
Top QSS	7490	7210
Top y1 SS	7565	7290
Top peak of SS triplet	7726	7450
Y2 Limestone	7900	7620
Sharp LHS peak at base of 50 foot shale	8075	7793

(Lines connecting these points are shown on figure 2).

The lithologies at SED-1 were determined by comparison with those associated with similar correlatable features at ED-1. Most LHS trending peaks were taken to represent sandstone (limestone at one level). RHS peaks were taken to represent shale or siltstones. The lithologies at ED-1 were obtained from the mud log.

It is recognised that there will inevitably be errors in this type of lithological compilation, but it is believed that the top of the QSS at SED-1 (depth 7210 feet SS) is likely to be accurate. The Virtual Lithology log of SED-1 has been added to the figure 2 cross section showing the interpreted lithology compared to that of ED-1.

JW, 30 Sep 2011