

The application of NGS (Natural Gamma Ray Spectrometry) electrical diagram in identification of clay minerals formations of Pabdeh and Gurpi and the optimized mix of drilling mud in Kupal oil field.

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Abstract

The main purposes of this study include evaluation clay minerals of Pabdeh and Gurpi oil Fields For identification of problematic shale horizons in drilling and the application of the results for the optimization of drilling and the application of the results for the optimization drilling mud. For this purpose and with the use of different CGR and SGR diagrams (shale indicators), the lithological columns of wells were drawn, then their NGS diagram were evaluated. According to this study, the presence of most minerals of illite, montmorillonite and the mixed layer (Lower Asmari), montmorillonite, illite and Glauconite (Pabdeh), Glauconite and illite (Gurpi), lack of kaolinite and a small amount of Chlorite is noticeable. The results have been specified in the form of plotted drawings, and the general distribution of minerals in oil fields.NGS diagrams to the south East of lower Asmari show less disorder and the presence of the mineral Glauconite in this region can be a sign of change in the sedimentation conditions.The results of studies show shallow marine in this area.

Keywords: *NGS diagram, clay mineral, pabdeh and Gurpi formations, Kupal oil Field.*

Introduction:

The study of clay and shale minerals indifferent stages of exploration. The methods of machine analysis used in identification of clay minerals need the Sampling of core clays and cuttings. The use of different methods, especially in the subsurface samples can be useful and effective. One of these methods is the petrophysical method are ease and quickness, coverage of all the sedimentation sequence, the possibility of identification of the formation (Bogg, 1987). In the present study the electrical diagram of Natural Gamma Ray Spectrometry (NGS) has been used to identify the clays. This diagram is a reflection of the natural radioactivity of the Formations which its origin is radio isotopes with semi long life and with considerable amounts of Potassium, Turium and Uranium in the ground. The NGS apparatus is capable to measure the gamma rays emitted from these elements, measure the level of energy of each one of them and record their abundance separately (serra, 1989).This apparatus because of high concentration in the shale can be useful and effective in identification of clays (Blum et al, 1997), (Jurado, 1997) and (Serra, 1980).

Geology of the region

Kupal oil field is located in the north of Khuzestan province, at the central part of the graben of Dezful, alongside 60(km) of north of Ahvaz. The dimensional structures have been

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calculated on the horizon of Bangestan, with the length of 32 Km and the width of 4.5 km. The kupal oil field is an almost long and parallel, which has two Eastern-western humps. The western hump forms the main storage of kupal structure (Figure1). The present Kupal oil field has 42 wells and the number of completed wells in Bangestan storage is 14 wells. The main wells of Bangestan storage produce an average of 3800 barrels a day (www.eia.doe). The oil of Bangestan kupal storage is of light oil type (API: 34.5) and it is even lighter than the oil of Asmari storage. These two storages have no pressure connection with each other. With due regard to the studies which have been done in the graben of Dezful, the formation of pabdeh is called as a carbonate shale horizon enriched with clay material and Kazhdumi formation which is mentioned as the source shale, but regarding the Gurpi formation as a stone of origin there is a lot of doubts.

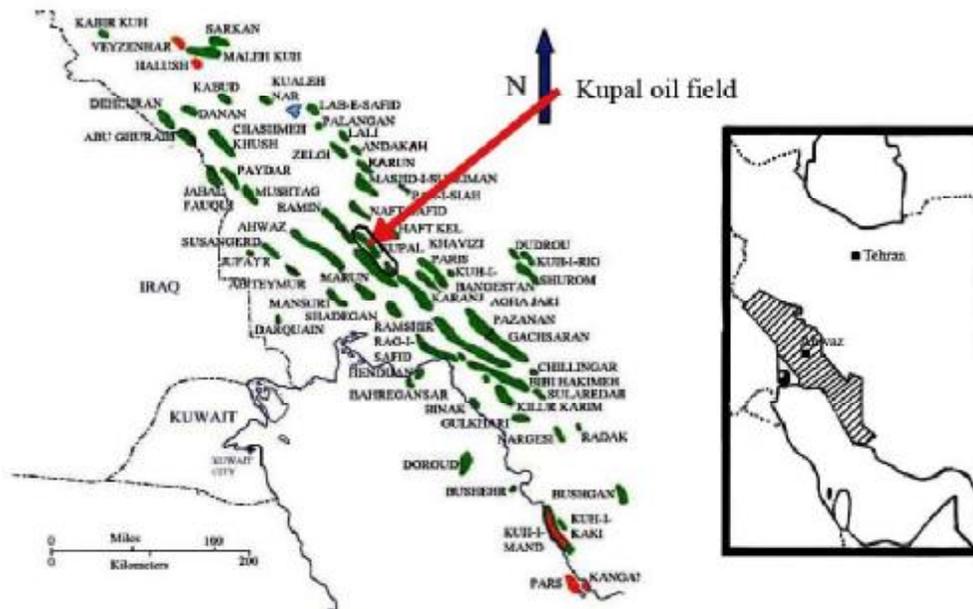


Fig-1) Situation of kupal oil field in others oil field in Iran.

The Method and Logs

After collecting of general information about Kupal oil field, the wells in which the formations of pabdeh and Gurpi have been completely drilled were identified, and with due regard to the results that have been obtained, four wells were chosen which had the most complete information and had a good distribution in the whole field, then the diagrams related to the considered depth distance were prepared and their preparation for study and interpretation was done. In this way, first with the use of density diagrams (FDC), porosity (CNL), photoelectric factor (PEF) and the diagrams of shale index (CGR, SGR), the lithology column of the wells was drawn, and then with the use of NGS diagram, the column of mineral clay related to each well was drawn, and in the study of NGS diagram first the amounts of K, Th, U and the ratios of Th/U and Th/K which is in the form of separate curves, were read, then the general amounts which have been obtained with the use of charts and special cross-plots were generally interpreted and the type of clays and their amounts were determined, and according to the obtained results the drawings with the same percentage from each mineral

was prepared to show the general distribution. With due regard to the big amount of information, here only the final results of distribution of clay minerals have been mentioned for different sections of each formation, with the use of information of four wells at the locations of North west (wells 12 and 36) and the south east of the field (wells 20 and 35). (Table 1). (More details are with the compilers).

Table.1: The main composition of clay minerals of formation in kupal oil field

well formation	Well NO.12	Well NO.20	Well NO.35	Well NO.36
Lower Asmari	illite, montmorillonite, mixed layer	illite, montmorillonite, mixed layer	illite, montmorillonite, Glauconite, mixed layer	mixed layer, illite, montmorillonite, Glauconite,
Pabdeh	illite, montmorillonite,	illite, montmorillonite, mixed layer	illite, montmorillonite, mixed layer, Chlorite	illite, montmorillonite, mixed layer
Gurpi	illite, montmorillonite, mixed layer	illite, montmorillonite,	illite, montmorillonite,	montmorillonite, mixed layer

For the approval of the obtained results, some samples of different sections have been chosen, and after the preparation and provision of clay slide (oriented slide), have been investigated with the use of XRD, and there was not such a big difference in the obtained results.

Discussion and Conclusion

Comparison of well diagrams and the changes of clay minerals in the Kupal oil field, at the lower Asmari from North West to the south east show less disorder. It can be the sign of the stability of the clay in this area. Also the percentage of illite also reduces. Although with the increase in depth one can observe the general trend of reduction of the distribution of illite clay minerals, mixed layer, Glauconite, montmorillonite and the little existence of chlorite mineral. But at different sections of different formations the amount clay minerals changes. With the increase in depth we can see the following sequence: Lower Asmari (Illite, montmorillonite, mixed layer and Glauconite), pabdeh (Illite and montmorillonite) Gurpi (montmorillonite, Illite, and mixed layer). So we can say: the distribution of Illite and the little percentage of montmorillonite are related to the alteration of the montmorillonite mineral. The dewateration of montmorillonite at temperatures of 70 to 150 degrees can cause a change of this mineral to illite (Weaver, 1986) and (Midtbq, 2000). It seems that the montmorillonite can also appear with the clays of mixed layers (Prother and Schwab, 1965). Lack of abundance of montmorillonite can be considered a shallow marine condition of the basin (Slatt, 2002). The chemical fluid can be important. The presence of glauconite is specified for the shallow and turbulent sea waters (Odin and Fullagar, 1988). So existence of it in the layer sequence can be an evidence for the changes and the instability of the basin. The secondary origin of some parts of glauconite can be of illite, present in the organic material. This matter can have a negative effect on the frequency of illite.

The use of geophysical methods is very efficient and reliable. The sample and microscopic and also the use of geochemical methods can be considered for identification of mineral types, rock the sedimentation area. For the prove samples from the different parts of each formation were chosen. After preparation and provision of clay slide with the help of XRD were examined. There was not a big difference in the obtained results. Based on this study, the presence of most of the minerals of illite, montmorillonite and the mixed layer (in pabdeh formation), montmorillonite, Illite and the layer mixture (in the Gurpi formation) in quantity and lack of kaolinite and the small amounts of chlorite is considerable. The increase processes of the mineral illite and the decrease process of kaolinite with the increase in depth shows the function of the process burial diagenetic in these formations.

The increase process of the intensity ratio (IR) shows this matter. Lack or their weak presence of minerals kaolinite and chlorite can be the sign of sedimentation of pabdeh and Gurpi formations in the marine area. But the lack of montmorillonite in pabdeh and Gurpi can be the sign of the deepening of the area. Its frequency with other minerals shows the instability of the basin. Also, the identified clay minerals don't show a special process in the horizontal direction. They are accompanied by fluctuations which can be related to the fluctuations of the basin. The frequency of Illite in pabdeh and Gurpi show the change of the basin conditions in comparison with the lower Asmari: The formations of Pabdeh Gurpi in the kupal oil field are not completely shale in the view point of lithology, and according to the lithology estimates which have been done based on electrical diagram, a carbonate- shale layer (pabdeh formation) and a clay carbonate layer, to some extent marl (Gurpi formation) can be considered. Based on the mentioned clay compound of shales, in the area of type "D" "problematic shales will be drilled. Incomplete identification of kaolinite (or very weak existence and less than the threshold sensitivity of the instrument) can be because of unsuitable chemical compound or the diagenetic change of the illite.

KUPAL OIL FIELD

Well. NO . 36

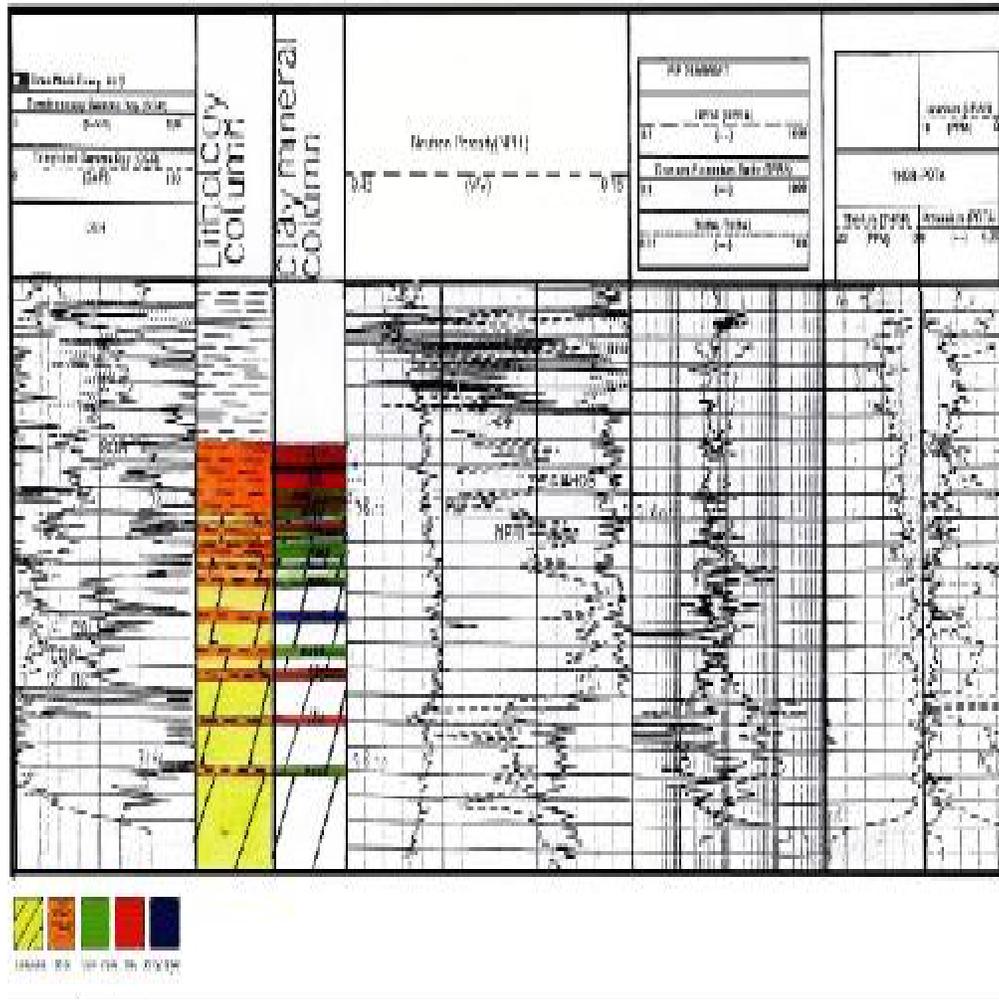


Fig-2) Composed log of well.No.36 of kupal oil field, the application of NGS electrical diagram in identification of clay minerals whit Th/k, K, Th ratio.

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