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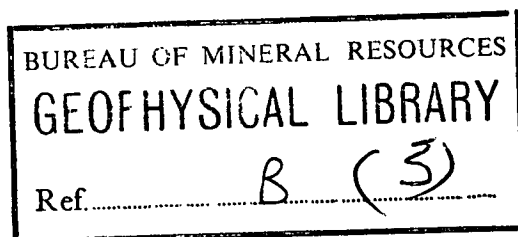
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DEPARTMENT OF NATIONAL DEVELOPMENT.
BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS.

RECORDS:

1964/92



PETROGRAPHY AND CORRELATION OF SOME PERMIAN FORMATIONS
IN PLANET WARRINILLA NORTH NO.1. QUEENSLAND.

by

M. Arman

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ABSTRACT

A lithologic correlation study has been carried out between the outcrops of Staircase, Aldebaran, and Catherine Sandstones, and of Peawaddy Formation on one hand, and certain sandstone units encountered in Warrinilla North No.1 well on the other.

The Peawaddy Formation and Catherine Sandstone, and to a lesser extent, Aldebaran Sandstone, were found to correlate well with the subsurface units between 3280 feet (i.e. the top of the section examined in the well) and 3725 feet, 3725 and 3850 feet, and 4016 and 4900 feet respectively. The Staircase Sandstone and the unit between 4920 and 5645 feet show rather marked differences in their lithologies, but are tentatively correlated on account of general similarity in their sequence.

It may be noted that except in the case of Peawaddy Formation, all the outcrops, possibly due to weathering effects, contain less feldspar but more kaolinite and illite matrix compared with the subsurface sandstones. The data also suggest that lithologic affinities tend to improve upward from the Staircase Sandstone to the Peawaddy Formation.

INTRODUCTION

The following is an attempt to correlate certain sandstone units encountered in Warrinilla North No.1 well with the outcrops of Staircase, Aldebaran and Catherine Sandstones and of Peawaddy Formation, (Mollan, Exon and Kirkegaard, 1964), which occur along the Serocold - Springsure Anticline to the West and North West of the well.

For this purpose the author has carried out a continuous binocular examination of cuttings sampled mostly at every ten feet interval between 3280 feet and 5980 feet, and a petrographic study on thirty thin sections cut from samples selected from the section. Electric logs of the well, taken from the Well Completion Report by N.A. Meyers, 1963, have also been used in order to facilitate the determination of the unit boundaries. The accompanying log shows the cuttings descriptions, the petrographic data, as well as the electric logs and unit divisions.

The surface samples used in the correlation include more than sixty thin sections, and were collected from localities between fifteen and fifty miles from the well. These samples have been examined previously by L.V. Bastian, and A.E. Fehr, the description of which was confirmed for the most part by the author.

In the following, the lithologies of the sandstone units of the well are described first, followed by a lithologic comparison study between them and the sandstone outcrops mentioned above,

PETROGRAPHY

4,920 - 5,645 feet unit.

Microscopic examination of six samples selected from this unit shows that the rocks are fine-grained sandstones with quartz content ranging from about 50% to 70%, and little or no grains with metaquartzite textures. The quartz has a small to moderate amount of fluid inclusions, a few overgrowths and some wavy extinction due to strain. The unit contains between 10% to 15% feldspar (mainly potash feldspar), but is poor in mica, which is either absent or present only in small amounts. 'Chert' (or devitrified glassy rocks of volcanic origin?) is common, being about 10% to 15% in most specimens, whereas kaolinite matrix is minor in some specimens and virtually absent in others. Micaceous rock fragments are common (5 to 15%), and consist mainly of shales, micaceous siltstones or schists. There is also some (5 to 10%) calcareous cement and replacement in most specimens.

The grains are generally subangular to subrounded, of low to moderate sphericity, and mainly have moderate sorting. Some degree of pressure solution is present throughout except in one specimen (from 5,600 feet depth) where it appears to be absent.

The unit between 4,900 - 4,920 feet consists of medium grey to brown and greenish shale and dark grey siltstone. This unit, as well as the medium to dark grey shale and siltstone unit between 3,850 and 4,016 feet, were not studied in detail, and therefore are not discussed further here.

4,016 - 4,900 feet unit.

This unit includes shale and siltstone intercalations in the upper two thirds, while the lower third, i.e. below 4,620 feet, consists of sandstone and conglomerate with thin horizons of fossiliferous calcareous sandstone at 4,640 - 4,650 feet and 4,760 - 4,780 feet.

The sandstone is fine to medium grained with quartz content ranging from about 55% to 80% (averaging about 70%), and especially towards the top of the section a few percent metaquartzitic textured grains. The quartz has a moderate amount of fluid inclusions, common to abundant overgrowths and fairly pronounced undulose extinction. Feldspar content is lower than that in the preceding unit, being only between 5% and 10%. 'Chert' (or devitrified glass) is again common (5 - 15%), and kaolinitic matrix is either absent or present in minor amounts. Other rock fragments constitute up to 10% of the samples and are mainly shales or sericitized grains. Calcareous cement or replacement is also present in some specimens, whereas in the case of the calcareous sandstone the proportion of the calcareous material is as high as 60%.

The grains are mostly subangular to subrounded, of moderate to high sphericity and poorly to fairly well sorted. Pressure solution varies from moderate to abundant in most specimens.

The matrix in the conglomerate is predominantly quartzite and subrounded, with some shale, siltstone and micaceous rock fragments, and a few fragments of metaquartzite and rhyolite. The pebbles consist of greenish grey to dark shale and siltstone, and are of various sizes up to 4 cm. In parts, the pebbles constitute more than half of the rock.

3,725 - 3,850 feet unit.

This unit consists of fine grained sandstone having a fairly high percentage of quartz (about 70% on the average) and little or no metaquartzitic textured grains. The quartz has generally few inclusions, some overgrowths and pronounced wavy extinction. The unit is rather rich in feldspar, being around 15% in most samples, and 10% in one. As in the previously mentioned two units, here potash feldspar is more predominant than plagioclase. 'Chert' is rather prominent at the base, but becomes minor throughout most of the section. The opposite pattern of occurrence applies to micaceous rock fragments, i.e. minor at the base, and more prominent (about 10%) towards the top. Kaolinite is absent in most specimens.

The grains are mostly subangular, of moderate sphericity and are moderately to well sorted. Pressure solution is abundant in all specimens except in the calcareous sandstone where it is absent.

The above description shows that the lithology of this unit is generally similar to that of arkose, except that the latter is usually coarser grained.

CORRELATION

On comparing the lithologic units of Warrinilla North No.1 well with the surface samples of Staircase, Aldebaran and Catherine Sandstones and of Peawaddy Formation, it was found that the subsurface unit of 3,725 - 3,850 feet interval corresponds well lithologically with the Catherine Sandstone. Like the Catherine Sandstone, which is more feldspathic than the underlying sandstones, the unit referred to above is also richer in feldspar than those below. They are also similar in other petrographic features, e.g. angularity, grain size, amount of chert and amount and type of other rock fragments.

Furthermore, the overlying sandstone unit between 3,326 and 3,460 feet is lithologically very similar to the sandstone of the Peawaddy Formation, with both containing up to 40% calcareous cement, 25% volcanic and chert fragments, up to 18% feldspar, and as little as 15% quartz. In addition, in both cases the grains are fine to medium, mainly subangular to angular, and little or no overgrowth, pressure solution or inclusion. It appears, therefore, that a correlation between these units is highly probable, and thus gives strong support to the correlation between the units immediately underneath.

It should be noted that unlike in the 3,725 - 3,850 feet unit, the Catherine Sandstone outcrops contain virtually no plagioclase, a fact which explains the slightly lower percentage of total feldspar in the Catherine outcrops. Also, compared with the 3,725 - 3,850 feet unit, the Catherine Sandstone has more kaolinite and illite matrix (by 5% to 15%) and less quartz (by 10%). However, these differences in the amounts of feldspar, kaolinite and illite matrix may not be significant inasmuch as they could be a result of weathering on the outcrops.

If we thus accept the correlation between the 3,725 - 3,850 unit, and the Catherine Sandstone, it would seem from the underlying sequence that the 4,016 - 4,900 feet unit could probably be correlated with the Aldebaran Sandstone. On comparing their petrographic features, it was again found that the outcrop samples of the Aldebaran, like those of the Catherine Sandstone, have less feldspar (in fact there is little or no feldspar in most specimens), and more kaolinite and illite matrix by 10% to 25%. Further, the outcrop samples have less quartz (by 5 to 15%), more metaquartzitic textured grains (by 5 to 15%) and generally more fluid inclusions in the quartz grains. It is suggested that the difference in the proportion of rock fragments is probably due to the area of the outcrops being closer to the supposed source area, whereby the rock fragments become more disintegrated, and hence decrease in proportion relative to quartz, as they are transported further into the basin of deposition.

The pattern of lithologic differences mentioned above applies also for the correlation of the 4,920 - 5,645 feet unit with the Staircase Sandstone, except for the amount of quartz, for which they are similar. * It was also found that compared with the subsurface unit the outcrop samples have generally more quartz overgrowth, no calcareous cement, somewhat less micaceous rock fragments at least in some specimens, and better rounded and coarser grains. Although the facts that surface samples have coarser and better rounded grains do not necessarily lessen the correlation probability between the two - since coarser grains would tend to have better roundings than finer grains, given the same parent material and drainage conditions - there still remain significant differences in the extent of overgrowth, amount of rock fragments and calcareous cement. Lithologically, therefore, a correlation between the Staircase Sandstone and the 4,920 - 5,645 feet unit would not be likely as the lithologic differences between them are rather marked.

However, on the basis of similarity in sequence, it is probable that these units may still be correlated. The petrographic features of two thin sections cut from subsurface samples below 5,645 feet appear to be fairly similar to those of two thin sections of surface samples of Cattle Creek Formation, in that they are both calcareous and rather rich in chert fragments. Furthermore, the Cattle Creek Formation and the unit below 5,645 feet contain limestone horizons, while higher in the sequence, the Staircase Sandstone and the 4,920 - 5,645 feet unit are both overlain by shale (? Sirius Shale), which in turn is overlain by the Aldebaran Sandstone.

The foregoing correlation studies suggest that there is a tendency for the lithologic affinities to improve upward from the Staircase Sandstone to the Peawaddy Formation. This in turn may suggest that the source rocks and depositional environments were becoming more uniform from the time of deposition of Staircase Sandstone to that of Peawaddy Formation.

* For the purpose of this report the author follows an interpretation that Staircase Sandstone is present in Reid's Dome in outcrops which have previously been assigned to a lower part of the Aldebaran Sandstone. This matter is to be discussed in a record on the petrography of surface samples being prepared by L.V. Eastian.

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LITHOLOGIC LOG OF
WARRINILLA NORTH NO.1

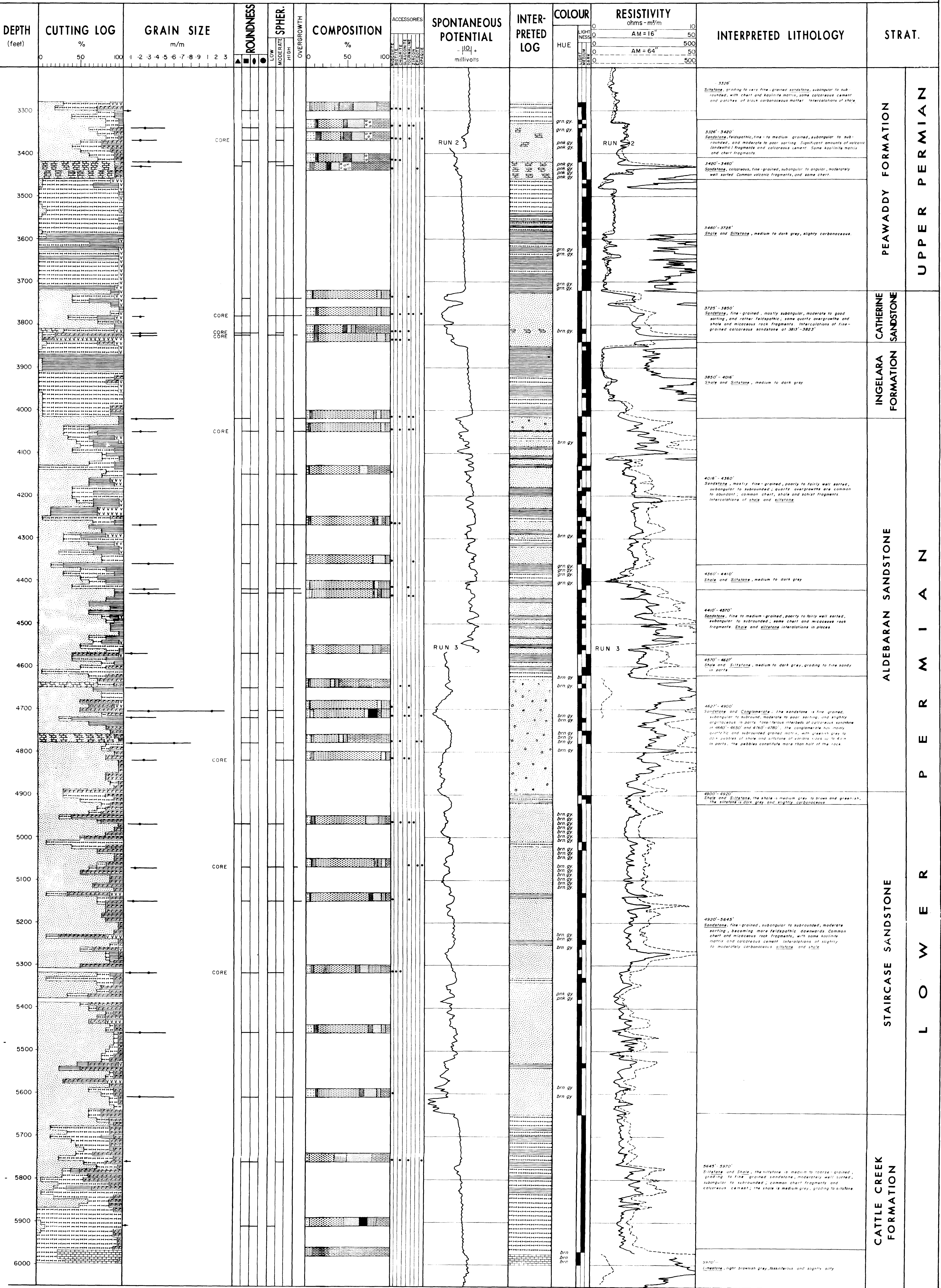
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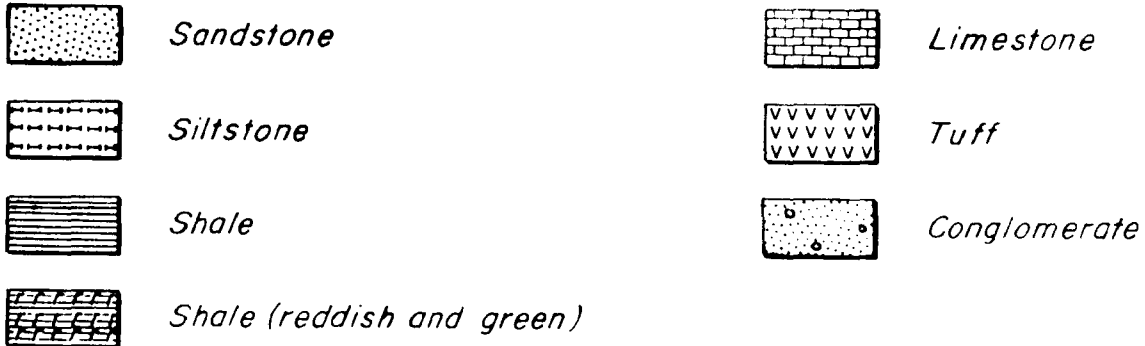
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1036' A.S.L. (R.T.)

3280' - 6000'

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