UPPER CRETACEOUS STRATIGRAPHY
OF
THE WELL GIANDARI 1
AND
ITS CORRELATION WITH THE
SULAIMAN AND KIRTHAR RANGES
WEST PAKISTAN

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S U M M A R Y .

The Giandari-1 well, drilled in the southern Suleman Range, started in the Paleocene Dunghan formation and then pene--trated a sequance of some 2,200 m of Upper Cretaceous sediments rich in diagnostic Foraminifera. Then the well passed through older formations which are outside the scope of this paper and was abandoned after reaching a total depth of 3,662 m.

These Upper Cretaceous formations have also been studied along several river sections in the mountain ranges of central West Pakistan and a correlation between these surface sections and the Upper Cretaceous penetrated in Gaindari is attempted.

I N T R O D U C T I O N

The well Giandari-1 was drilled by Pakistan Shell Oil Co Ltd. in the southern Sulaiman Range in 1958. It started in Paleocene shale of the Dunghan formation and then penetrated as sequence of Upper Cretaceous rocks representing the following formations : *

Pab formation.
Nishpa formation
Parh formation
Belemnite shale formation.

These formations and/or their lateral equivalents were also studied by company geologists in surface sections in the Sulaiman range Quetta-Loralai region in Kirther range.

With the exception of the Pab formation these sediments contain rich Upper Cretaceous forminiferal faunas. These larger and smaller Forminifera have been studied in Pakistan Shell's Labs: at Karachi and allowed accurate dating of the rocks penetrated.

*) for terms used in Upper Cretaceous rock stratigraphy of West Pakistan reference is made to the correlatio chart given by WILLIAMS (1959).

Pab formation

This formation consists mainly of grey, greenish or reddish brown quartzose sandstones, with grain size varying from very fine to coarse. Sometimes they are glauconitic and in parts calcareous with carbonaceous streaks. Thin oolitic limestones occur in the upper and a few shaly beds in the lower part. In between these are some greenish to dark brown, partly calcareous grits and some micaceous siltstone layers.

Some oyster beds occur in the upper and in the lower part of the formation, indicating marine environment, whereas the grits point to continental conditions for the middle part.

Age -indicating fossils are lacking in these beds but the black shales of the overlying Dunghan formation contain a rich pelagic fauna of Paleocene age and the underlying Nishpa formation ranges from Campanian into Maastrichtian; this dates the Pab formation at this locality within fairly narrow limits.

Nishpa formation

The top part of this formation is formed by sandy calcareous shales. The bulk of the formation consists of light to dark grey, in part sandy, mostly argillaceous, foraminiferal or compact limestones.

Larger and smaller Foraminifera indicate a Campanian to Maastrichtian age for the Nishpa formation.

Parh formation

The Parh formation consists of light coloured, porcellaneous limestones in its upper part and argillaceous limestones with some intercalations of calcareous shales in the lower part.

Common to rich foraminiferal faunas have been found throughout the formation, clearly pointing to a continuous sequence from Upper Cenomanian to Lower Campanian.

Belemnite Shale formation

The main part of this formation consists of dark grey to black, micaceous and carbonaceous claystones and is of early Cretaceous age. Only its silty and somewhat calcareous top part is of late Cretaceous age (Cenomanian), as is indicated by diagnostic smaller Foraminifera.

THE UPPER CRETACEOUS IN WEST PAKISTAN

As during the greater part of late Cretaceous times (Cenomanian to Santonian) sedimentation was rather uniform throughout Western Pakistan, the formations found in Gianderi-1 can be correlated well with those encountered in the rest of the Sulaiman range, the Quetta-Loralai region and the Kirthar range. During Campanian- Maastrichtian time local uplifts in the Sibi-Jacobabad area gave rise to two basins the deposits of which differ somewhat from each other.

Belemnite Shale formation

In the region west of the River Indus the deposition of these shales persisted into Cenomanian times only in the Giandari area. In the other areas the limy Parh facies had already started developing during the Albian.

Parh formation

In the southern (GajRiver), northwestern (Quetta area, see also CITA and RUSCELLI,1959) and northern (Mughal Kot) regions the change from the Belemnite shales to the sediments of the Parh formation took place during the Albian. The Parh facies then gradually extended reaching the Peromanda-Sembar area at the beginning of the Cenomanian and the Giandari area in later Cenomanian times.

Sedimentary conditons were uniform throughout the basin. The lower part of the Parh formation shows predominantly argillaceous limestones alternating with calcareous shales. The upper part of the formation is composed of the typical porcellaneous limestones with only minor shale inter-calations and some chert. The whole formation contains rich pelagic foraminiferal faunas which allow accurate age determinations, the lower bounday of the formation being Albian to Cenomanian, the upper one Campanian to Maastrichtian.

During the deposition of the upper part of the Parh formation some uplifts, the Sibi high being the most important one, divided the single sedimentary basin in which the Parh formation was deposited into two main basins, the upper and lower Indus basins. These basins have different sediments overlying the Parh formation: the Nishpa formation in the north (upper Indus basin) and the Orbitoides limestone in the south (lower Indus basin).

Nishpa formation - Orbitoides limestone

The Nishpa formation is developed in the whole Sulaiman range and westwards upto the Sembar section. It is missing (erosion or non-deposition) in the Peromanda section and from Quetta southwards its lateral equivalents, the Orbitoides limestones etc; are found.

The Nishpa formation consists mainly of light green to black calcareous shales with intercalations of argillaceous limestones and some fine-grained calcareous sandstones. In the Mughal Kot section the basal part of this formation contains reworked pebbles of Parh limestone.

Towards the south(Giandari) the upper part of the formation gradually becomes more calcareous.

The Nishpa formation is generally rich in larger Foraminifera (Orbitoides, Omphalocyclus, etc.) and contains also a few diagnostic smaller Foraminifera, allowing an age determination Campanian to Maastrichtian.

The Orbitoides limestone, argillaceous and sandy in places, is developed in the Quetta region and southward (Bhangi Nala section). The formation is rich in larger Foraminifera indicating a Maastrichtian age.

In the Gaj River section we find a sequence of shales with Maastrichtian pelagic Fora minifera.

Pab formation

The deposition of the Nishpa formation and Orbitoides limestone was followed by a general retreat of the sea with a great influx of clastic material. Marine conditions were replaced by alternating continental and deltaic facies. Marine recurrences occured sporadically (oyster beds, oolitic limestones).

In the south (Bhungi Nala) the formation is represented by sandstones and gritstones. In its basal part it contains intercalations of gauconitic limestone and calcareous sandstone.

In this area Globotrucana spp. and larger Foraminifera have been found, indicating a Maastrichtian age (NAGAPPA, 1959). The Pab formation is missing in the Gaj River -Quetta -Peromanda region, but is present again in the eastern part of the Loralai area (Sembar) and in the Sulaiman Range. It consists mostly of hard, massive, cross-bedded quartzitic sandstones with some shaly intercalations and conglomeratic beds. In the northern Sulaiman Range (Mughal Kot) the cross-bedded quartzitic sandstones contain intercalations of carbonaceous shales with abundant plant remains.

In the Sulaiman Range and Loralai region age-indicating Foraminifera have only been found in the Sembar section, where some shales in the top part of the Pab formation contain a very rich and characteristic fauna of Maastrichtian age.

The time around the Cretaceous-Tertiary boundary is marked by a further retreat of the sea. In most of the sections under consideration there is a disconformity between the Maastrichtian and the Upper Paleocene Dunghan formation, suggesting that the area was a high in the intermediate period. In the Giandari area the grits of the Pab formation may have been deposited during this time interval, while the upper part of the formation (with oyster beds) may mark the beginning of the new transgression, in which case the Pab formation in this area would reach upwards into the Paleocene.

In the south (Bhungi Nala area) sedimentation took place uninterrupted into Paleocene times (Cardita beaumonti beds)

Cardita beaumonti beds

These beds consist of olive-green shales with limestone nodules and contain abundant Carditas. The age is believed to be Maastrichtian to lowermost Paleocene. Globotruncana spp. is still present in the lower part of the beds, but no diagnostic Foraminifera could be found in the higher parts . The Cardita beaumonti beds are overlain by the Paleocene Ranikot formation.

FORAMINIFERAL FAUNAS OF THE UPPER CRETACEOUS

The top part of the Belemnite Shale formation and the Parh formation are rich in diagnostic pelagic smaller Foraminifera which show the same development as in the Mediterranean area, etc. They allow accurate age determinations for the interval Albian to Maastrichtian. However, in the Nishpa formation and Orbitoides limestone they are very rare. Here rich larger foraminiferal faunas of Campanian-Maastrichtian age are found.