Chapter I

LITHOSTRATIGRAPHY OF MEASURED SECTIONS

INTRODUCTION

The formation under study was originally named 'Jaisalmer limestone' by Oldham (1886 a,b) and was redesignated as the 'Jaisalmer Formation' by Swaminath et al., (1959). The formation was divided into four mappable members by Narayanan et al., (1961). Das Gupta (1975) revised the stratigraphy and added one more member to the formation. In the present study, Das Gupta's (1975) classification of the Jaisalmer Formation into the following five members was followed:

5. Kuldhar Member (top member)
4. Bada Bagh Member
3. Fort Member
2. Joyan Member
1. Hamira Member (basal member)

The Hamira Member has an intertonguing relationship with the underlying Lathi Formation. The upper boundary of the Jaisalmer Formation is gradational and the Kuldhar Member represents a lithological and faunal transition to the overlying Baisakhi Formation.

The fauna of the Jaisalmer Formation consists of brachiopods, pelecypods, gastropods, echinoids, crinoids and corals. The Kuldhar Member contains ammonites, belemnites,
brachiopods and pelecypods. The fossil assemblage indicate Callovian-Oxfordian age of the Jaisalmer Formation.

The thickness of the Jaisalmer Formation increases towards N, NW and W (Misra, 1982). In the outcrop area maximum thickness of the formation is about 400 m but in the sub-surface maximum thickness is about 1200 m near the Pakistan border. In the study area maximum thickness of the formation is 105 m.

**HAMIRA MEMBER**

A lithostratigraphic section of the Hamira Member was measured in the scarp near Thaiat village (Fig.3). The member is 23 m thick and is divisible into three parts on the basis of gross lithology and sedimentary structure.

The lower 12 metres comprise a coarsening upward terrigenous sandy sequence ranging from very fine sandstones at the base to fine-medium sandstones at the top. The sandstones are slightly compact to friable and show grey, yellow and purple colours. Purple coloured, shale-siltstone intercalations are common in the lower part. Well rounded clay pebbles, 0.5 cm to 3 cm in size, and burrows and trails are common in the sequence. Hard, dark purple coloured, thin, irregular layers of ferruginous sandstone occur throughout the sequence but become quite common towards the top. The bedding types and sedimentary structures of the sequence show a systematic variation from bottom to top. In the lower part thin laminations, ripple laminations and ripple cross-laminations occur and bioturbation is common (Plate I, Fig.4). Upward in
<table>
<thead>
<tr>
<th>Bedding and Sedimentary Structures</th>
<th>Rock Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0 m Calcite sandstones passing upward into dolostones. Horizontal laminations, ripple-cross-laminations and beds with low-angled discordances.</td>
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</tr>
<tr>
<td>8.0 m Shales, mostly covered. Interbeds of mottled, burrowed siltstone - sandstone.</td>
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<tr>
<td>12.0 m Sandstones, mostly friable, very fine-to medium-grained. Very thinly-laminated and ripple laminated shale-siltstone interbeds in the lower part. Hummocky &amp; single sets of planar cross-bedding in the middle part. Cosets of planar and trough cross-bedding at the top. Shale pebbles and burrowing common throughout.</td>
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Fig. 3 Measured stratigraphic section of the Hamira Member.
the sequence hummocky cross-bedding and large-scale planar and trough cross-bedding is developed. The top of the sequence is mainly cross-bedded with occasional intercalations of shale and shale pebbles. The set thicknesses of cross-bedding generally range from 5.5 cm to 7.5 cm. Inclination of cross-beds ranges from 3° to 29°, averaging 16°.

The middle 8 m thick sequence of the Hamira Member is dominantly argillaceous and mostly covered by scree derived from harder lithologies exposed upward in the sequence. Occasional beds of red and yellow-green silty claystones outcrop and these beds are 20 cm to 25 cm thick. Some harder outcropping beds comprise highly ferruginous sandstones which appear rusty brown on weathered surfaces. Mottling and irregular bedding are common in ferruginous sandstones. Burrowing is common and in some beds traces of bedding have been completely destroyed resulting in homogeneous appearance.

The upper 3 m thick sequence of the Hamira Member comprises calcareous sandstones passing upward into dolostones. The lower one metre of this sequence comprises mainly yellow-brown calcareous sandstones with occasional interbeds of dolostones and friable sandstones. The calcareous sandstones are very thin-bedded with bedding thicknesses ranging from 1 cm to 3 cm. The very thin beds of calcareous sandstones show alternating horizontal laminations and ripple cross-laminations. Some, 8 cm to 22 cm thick beds show large-scale cross-bedding. Some of these beds show planar cross-bedding with steeper inclination of cross-beds whereas other beds comprise bedsets with low angled discordances. The upper 2 metres of the sequence mainly
PLATE I

Photographs showing lithologic and sedimentary characters of the Hamira Member and the Joyan Member

Figure A. Thinly laminated and bioturbated sandstones from the lower part of the Hamira Member.

Figure B. A general view of the Joyan Scarp.

Figure C. Shale pebbles in the lower sandy part of the Joyan Member.

Figure D. Wackestones-packstones in the upper part of the Joyan Member showing bioturbation and partly disturbed laminations.

Figure E. Dolomitized wackestone-packstone with abundant flat pebbles in the upper part of the Joyan Member.
comprise yellow-buff coloured fine-to-medium-grained terrigenous dolostones. They are thin-bedded with thicknesses of beds ranging from 20 cm to 40 cm. The dolostones generally comprise fine-grained shell debris and terrigenous sand grains. The bedding types comprise ripple cross-laminations and parallel laminations. Mottling is common due to dolomitization.

JOYAN MEMBER

A lithostratigraphic section of the Joyan Member was measured (Fig. 4) across the hill located near Joyan village (Plate I, Fig. B).

The Joyan Member is 13.5 m thick in the section. The basal 4 metres of the member comprise fine to very fine silty sandstones interbedded with shales-siltstones and shale pebble breccia. The colour of the rocks is generally yellow and olive and appears rusty brown on weathered surfaces. The various lithologies occur in up to 20 cm thick beds. The sandstones are laminated to very thin-bedded; thicknesses of beds range from 5 mm to 5 cm. The sandstones and flat pebble breccia are generally soft and friable with little calcite cement, but those with abundant dark brown ferruginous matrix form hard layers. The hard layers also contain ferruginous nodules and concretions. The concretions vary in size and shape but many are tube-like. They are generally hollow and have a central cavity. The rim of the cavity is lined by a limonitic layer.

The bedding types and sedimentary structures include parallel, very thin laminations (one mm thick laminae) in
### Bedding and Sedimentary Structures

<table>
<thead>
<tr>
<th>Rock Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5m</td>
<td>Wackestones-packstones, with pellets, bioclasts and whole fossils. Nodular bedded &amp; bioturbated. Very thin-bedded/laminated, calcareous very fine sandstone - siltstone interbeds in the lower part. Dolomitization &amp; flat pebbles common in the upper part. Cross-bedded grainstones at the top.</td>
</tr>
<tr>
<td>4.0m</td>
<td>Shales, weathered and mostly covered</td>
</tr>
<tr>
<td>4.0m</td>
<td>Sandstones, silty, soft, friable, fine to very fine-grained, interbedded with shales-siltstones. Very thin-, flat- and wavy-bedding and ripple cross-laminations in sandstones. Single sets of large-scale planar cross-bedding in the upper part. Shale pebbles common, also occur along the foresets of cross-bedding. Burrows common.</td>
</tr>
</tbody>
</table>

Fig. 4 Measured stratigraphic section of the Joyan Member.
shales-siltstones, and flaser bedding, wavy bedding, ripple
cross-laminations and large-scale cross-bedding in the
sandstones. The large-scale cross-bedding occurs in the upper
part of this sequence. It is of planar type and occurs in
single sets. The foresets of cross-bedding are marked by
their heterogeneity of composition and colour. Olive coloured
shale pebbles and ripple cross-laminations also occur along
the foresets of cross-bedding.

Shale pebbles are common throughout the sequence and
in some beds are so abundant as to form a breccia 'bed
(Plate I, Fig.C). The pebbles are olive, yellow, purple
and buff coloured. Their shape and size are variable. They are
irregular to oval and rounded, and range in size from less than
a millimetre to 4 cm.

The overlying 4 metres comprise olive green shales which
are weathered and mostly covered with scree.

The next 5.5 metres comprise buff-yellow pelletal wackestones-
packstones which are interbedded with greenish-yellow very
fine calcareous sandstones-siltstones in the lower part.
The sequence is capped by bioclastic grainstones. The pelletal
wackestones-packstones contain whole fossils, large unabraded
fragments of mostly gastropods and echinoderms, terrigenous
material and glauconite. The wackestones-packstones have
irregular and nodular bedding. Bioturbation and mottling are
common, but bedding, where preserved, consists of very thin
beds and laminations ranging in thickness from a millimetre
to 5 cm (Plate I, Fig.D). Bioclastic grainstones forming the top of the sequence are cross-bedded and have ripple marks of asymmetrical and interference types. The cross-bedding is both planar and trough types and occurs mostly in single sets. The wave lengths of asymmetrical ripple marks range from 4.3 cm to 10 cm, averaging 7 cm.

In the upper 2 metres dolomitization and flat pebbles are common (Plate I, Fig.E). In the lower part of this sequence the flat pebbles are abundant and form breccia beds. The amount of flat pebbles decreases towards the top of the sequence. The flat pebbles comprise mainly micritic limestone but pebbles of calcareous siltstone also occur. The pebbles are rusty brown, red, yellow, grey and white coloured. Their shape and size are highly variable. They are elongated oval and spherical, and range in size from a millimetre to 19 cm.

FORT MEMBER

Lithostratigraphic sections of the Fort Member were studied and measured at seven locations along the prominent scarp over which the Jaisalmer Fort is situated. The scarp has a capping of harder limestone (Plate II, Fig.A). The thicknesses of the Fort Member in different sections range from 44 m to 17 m, decreasing along the scarp in the NE direction. The different sections of the Fort Member are designated A, B, C, D, E, F and G and are described below.
PLATE II

Photographs showing lithologic and sedimentary characters of the Fort Member

Figure A. A general view of the prominent scarp near the Jaisalmer Town. The Fort Member is exposed in the scarp which shows a capping of harder limestone.

Figure B. Large-scale planar cross-bedding in calcareous sandstones towards the top of the Fort Member (Section A).

Figure C. 30 cm thick conglomerate bed towards the top of the Fort Member (Section A) showing well rounded pebbles.

Figure D. Ripple cross-laminations in grainstones in the upper part of the Fort Member (Section B).
Section A

The basal 12.5 metres of this section comprise grey, yellow and purple sandstones with interbeds of red and purple siltstone-shale which are common in the lower part (Fig. 5). The sandstones are soft, friable, micaceous and fine-grained. They are laminated to thin-bedded, the bedding thicknesses ranging from a few mm to 25 cm. The bedding appears wavy and hummocky but it is often irregular and disturbed due to bioturbation. The upper 4 metres of this sequence show single sets of planar cross-bedding followed upward by wedge-shaped cosets. The single sets of cross-bedding alternate with thinly laminated and bioturbated sandstones. The thicknesses of sets of cross-bedding range from 10 cm to 15 cm and rarely to 3 m. The inclinations of cross beds range from 8° to 29°, and average 20°.

The above described basal sandy part is overlain by 10 m thick calcareous shales with some limestones. The calcareous shales are olive coloured, soft and highly weathered. They rarely outcrop in the scarp being mostly covered by limestone scree fallen from above. The calcareous shales form nearly 90 percent of the sequence. In this shaly sequence a one metre thick band of limestone is prominent. The limestone is yellow coloured and weathered. It comprises bioclastic and peloidal wackestone-packstone with fine-grained terrigenous material. The limestone is characterized by nodular and wavy bedding.
Fig 5. Measured stratigraphic section A of the Fort Member.
The overlying 8 metres comprise limestones with interbeds of calcareous shales and rare calcareous sandstones. The calcareous shales are olive coloured, soft and highly weathered. The percentage of shales in this part decreases and is about 25 percent. The shales form a 1.5 m thick bed as well as thin intercalations. The limestones are yellow, purple and brown coloured and appear rusty brown on weathered surfaces. The limestones comprise mostly bioclastic and peloidal wackestones-packstones with ooids, and occasional grainstones. In comparison to interbedded shales, the limestones are very hard and resistant, and form prominent bands outcropping in the scarp. The limestones are characterized by nodular and wavy bedding and occur in 15 cm to 60 cm thick bands in which bedding is not apparent because of its nodular and irregular nature. However, bedding is clearly seen at some places in the form of colour banding. The colour banding is the result of interbedding of yellow and purple coloured limestones and olive coloured calcareous shales. The bedding where discernable is 2 cm to 5 cm thick. In the uppermost 2 m part of the 8 m thick sequence under description, the limestones (wackestones-packstones) do not show nodular bedding. The wackestones-packstones occur in 15 cm to 20 cm thick bands separated by shales. The wackestone-packstone bands show alternating richly fossiliferous and poorly fossiliferous beds of 2.5 cm to 5 cm thickness. The bioclasts are dark brown and impart the same colour to beds in which they are abundant. Terrigenous material also occurs in these limestones. Other beds, poor in bioclasts, are purplish and
grey coloured. Ooids are present in the upper 4 m thick part of the sequence. Hard and resistant interbeds of calcareous sandstones occur rarely.

The above described 8 m thick sequence is overlain by 2 m thick, buff and purple coloured limestones appearing rusty brown on weathered surfaces. The limestones comprise mostly bioclastic, peloidal and ooidal grainstones and occasional wackestones-packstones. The limestones occur in 15 cm to 20 cm thick bands which show parallel and ripple cross-laminations. Bioclasts occur concentrated in a few millimetre to 3 cm thick beds. Calcite infilled elongated, lenticular cavities, upto 8 cm long are seen along the bedding. Subrounded to well rounded, elongated intraclasts, upto 13 cm long, occur occasionally, associated with fossiliferous beds. Towards the top, grainstones show trough cross-bedding. The troughs, seen on the upper bedding surfaces, range in width from 5 cm to 35 cm and show a width length ratio of 1 : 1.5. Linguoid ripple marks are seen on the upper bedding surfaces. Parallel laminations with low angled discordances are also observed in the grainstones.

The overlying 5 metres comprise interbedded soft calcareous shales and resistant limestones which are mainly bioclastic wackestones with peloids and common terrigenous material. Nodular bedding is characteristic of this sequence. The sequence is capped by a poorly washed peloidal grainstone.
The next 1.5 metres comprise very hard, buff and purple coloured calcareous sandstones with some bioclasts, occurring in 20 cm to 30 cm thick beds. The bedding types of sandstones include parallel laminations and cross-bedding. Cross-bedding is of large-scale planar (Plate II, Fig. 8) and trough types with set thicknesses ranging from 7 cm to 10 cm and more. Asymmetrical and interference type of ripple marks occur on the upper bedding surfaces. The asymmetrical ripple marks have slightly undulating to straight crests. Ripple wave lengths range from 5 cm to 10 cm. Asymmetrical ripple marks are also developed on foresets of cross-bedding. Such ripple marks show asymmetry 180° to the cross-bed azimuths indicating reversal of current direction. At the top there is a calcareous sandstone bed showing numerous cavities which are mostly parallel to the bedding and upto 10 cm in length. These cavities represent removed intraclasts.

The overlying 1 m comprises limestones which include terrigenous bioclastic-peloidal grainstones characterized by highly irregular and disturbed bedding due to bioturbation, and numerous cavities upto 8 cm in length, elongated and parallel to bedding. Elongated pebbles of greyish colour, upto 6 cm in length and less than 1 cm in width are present and show rounded ends. Pebbles are also seen on the bedding surfaces and are angular to subrounded, measuring in length upto 5 cm.

Next is a 30 cm thick conglomerate (Plate II, Fig.C). The pebbles have a maximum size of 10 cm. The pebbles are
generally elongated but some are equidimensional. They are mostly well rounded and consist of red chert, purple laminated arenite, and white arenite.

The overlying 3.7 metres comprise fossiliferous limestones with interbeds of calcareous sandstones and rare lime mudstone. The limestones are golden yellow and yellowish brown coloured and appear rusty brown on weathered surfaces. They occur in 15 cm to 24 cm thick beds. The limestones comprise bioclastic and pelletal grainstones with common ooids, peloids, intraclasts and terrigenous material. They show large-scale planar cross-bedding. The interbedded calcareous sandstones are rusty brown coloured, occurring as a 60 cm thick band as well as very thin intercalations. The calcareous sandstones are hard and resistant, and show large-scale planar cross-bedding. Yellow lime mudstone occurs in a 20 cm thick band consisting of a few bioclasts of very small size.

Section B

The 3 m thick basal part of the sequence comprises olive coloured shales which are mostly covered and weathered (Fig. 6).

The overlying 8 metres comprise fine to medium sandstones of prevalent yellow and grey colour and occasionally black or purple. The sandstones are mostly friable and soft but occasionally harder band also occur. They are generally
<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 m</td>
<td>Grainstones with abundant peloids and bioclasts, and scattered terrigenous grains. Large-scale planar cross-bedding</td>
</tr>
<tr>
<td>2.5 m</td>
<td>Grainstones with occasional packstones and calcareous sandstone interbeds. Abundant fossil fragments and terrigenous material. Large-scale planar cross-bedding</td>
</tr>
<tr>
<td>3.0 m</td>
<td>Shales, weathered and mostly covered.</td>
</tr>
<tr>
<td>3.5 m</td>
<td>Shales, weathered and mostly covered.</td>
</tr>
<tr>
<td>5.0 m</td>
<td>Shales, weathered and mostly covered.</td>
</tr>
<tr>
<td>7.0 m</td>
<td>Wackestones and packstones with abundant fossil fragments and common whole fossils, peloids, and ooids. Interbeds of calcareous shales and occasional very thin calcareous sandstones. Wavy bedding in the lower part. Large-scale planar and trough cross-bedding, parallel laminations, ripple cross-laminations, and occasional asymmetrical ripple marks in the upper part. Few burrows in packstones.</td>
</tr>
<tr>
<td>9.0 m</td>
<td>Calcareous shales, calcareous siltstones and fine sandstones. Occasional beds of micro-bioclastic peloidal packstones—wackestones with whole fossils, and rare grainstones. Irregular and nodular bedding. Biofouling common. Large-scale planar cross-bedding and occasional shale pebbles in calcareous sandstones.</td>
</tr>
<tr>
<td>8.0 m</td>
<td>Sandstones, soft, friable and fine-grained to medium-grained. Thin-bedded to occasionally very thin-bedded. Irregular bedding due to biofouling. Even laminations with low-angled discordances. Horizontal even laminations occasional. Planar cross-bedding occurring in wedge-shaped cosets and tabular sets.</td>
</tr>
<tr>
<td>3.0 m</td>
<td>Shales, weathered and mostly covered</td>
</tr>
</tbody>
</table>

Fig. 6 Measured stratigraphic section B of the Fort Member.
thin-bedded and occasionally very thin-bedded; the bedding thicknesses range from 1.5 cm to 15 cm, and average 8 cm. The bedding types include even laminations with low angled discordances (laminations dipping 2° to 10°), planar cross-bedding occurring in wedge-shaped cosets and tabular sets, and irregular bedding due to bioturbation. The angle of inclination of cross-beds in wedge-shaped and tabular sets varies generally from 11° to 28°, and averages 19°.

The next 9 metres consist of calcareous shales (70%), calcareous siltstones and sandstones (20%) and occasional beds of nodular limestone (10%). The nodular limestones are yellow coloured and occur in 20 cm to 45 cm thick beds. The nodular limestones comprise microbioclastic peloidal packstones and wackestones, and occasional grainstones. Microbioclasts and occasional whole fossils of echinoderms, brachiopods and thin-valved pelecypods occur. Elongated cavities, upto 5 cm in length, probably represent leached fossils. Yellow and grey coloured calcareous siltstones and fine sandstones are soft, friable, and show irregular bedding. The calcareous sandstones have large-scale planar cross-bedding. Olive coloured shale pebbles are occasionally present. Burrowing was noted in calcareous sandstones. Calcareous shales are olive coloured and mostly covered.

The overlying 7 metres consist of mainly nodular limestones interbedded with shales and occasional very thin
(5 cm thick) calcareous sandstones. The nodular limestones are yellow to yellowish-brown coloured and appear rusty brown on weathered surfaces. The nodular limestones mainly comprise whole fossil wackestone and pelletal and bioclastic wackestones and packstones which also contain ooids in some beds. The limestones show alternate hard and soft beds which are 3 cm to 60 cm thick. The soft beds are generally weathered. The limestones are characterized by irregular, wavy and nodular bedding. They consist of mostly small to large fossil fragments and whole fossils of brachiopods, pelecypods, echinoderms and gastropods. Pelecypods have thin shell valves. Thin beds of clacareous sandstone are rusty brown coloured, hard and resistant, and contain some fossil fragments.

Next are 3 m thick, yellow, golden-yellow and buff coloured limestones. The limestones comprise bioclastic, peloidal and ooidal grainstones with occasional packstones. Grainstones form hard and resistant regular beds which are 14 cm to 60 cm thick. Packstones are reddish brown coloured and occur in 2 cm to 10 cm thick beds, some of which are rich in fossils. Fossils are represented by elongated fragments and some whole fossils of variable size. Leached fossils have left behind cavities showing a maximum length of 6 cm. Fossils and cavities are aligned parallel to the bedding. The lower half of the sequence shows wavy bedding and the upper half is cross-bedded with thin interbeds of parallel laminations and ripple cross-laminations (Plate II, Fig. D).
In the lower part of the cross-bedded grainstones, peloids are more frequent than the bioclasts whereas the upper part is richer in bioclasts. These limestones are occasionally associated with terrigenous micrite. Cross-bedding is of large-scale planar and trough types. Inclination of planar cross-beds ranges from 3° to 26°. Troughs are very well exposed on the upper bedding surfaces. The trough widths range from 4 cm to 10 cm, and dips of trough axis range from 10° to 28°. Fossils are abundant along the cross-bedding foresets and are more concentrated at the bottom of troughs. Asymmetrical ripple marks occasionally occur on the upper bedding surfaces. Terrigenous grains are commonly distributed throughout the sequence. Pebbles of lime mudstone are also common and their amount decreases towards the top of the sequence. Their concentration is more in some thin beds which are highly variable in thickness. Pebbles are yellow coloured, flat, elongated, subrounded to well rounded and highly variable in size ranging from 0.5 cm to 27 cm. They have left behind cavities on removal. Some dark coloured mottles are present. Burrowing is noticed in packstones.

The above described 3 m thick limestones are overlain by 1.5 m thick, weathered shales which are mostly covered with scree.

The shales are overlain by 2.5 m thick arenaceous limestones which are golden yellow and yellowish-brown but appear rusty brown on weathered surfaces. The arenaceous
limestones comprise mostly terrigenous bioclastic grainstones and occasional packstone interbeds. In some beds terrigenous content is quite high and the rock is calcareous sandstone with some bioclasts. Large-scale planar cross-bedding is common. Thicknesses of bedding and sets of cross-bedding range from 6 cm to 12 cm. The inclination of foresets ranges from 21° to 25°. Fossils are abundant along the foresets.

Next are 5 metres thick weathered shales which are mostly covered with scree derived from harder lithologies exposed upward in the sequence.

The overlying 2 metres comprise yellowish-brown and golden yellow coloured poorly fossiliferous limestones with purple coloured intercalations and are mostly covered with scree. The limestones consist of bioclastic peloidal grainstones with scattered terrigenous grains. They show large-scale planar cross-bedding. Fossils are represented by elongated and rounded fragments of very small size and are more abundant along foresets. Peloids are very small, rounded and ovoid.

Section C

The basal 4.5 metres comprise soft and friable, cross-bedded fine sandstones of pale yellow, grey and purple colours, appearing black on weathered surfaces (Fig. 7). Cross-bedding is large-scale planar type. Inclination of cross-bedding foresets ranges from 1° to 25°, averaging
DEODING AND SEDIMENTARY STRUCTURES

<table>
<thead>
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<th>DEODING AND SEDIMENTARY STRUCTURES</th>
<th>ROCK TYPE</th>
<th>DESCRIPTION</th>
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<tr>
<td></td>
<td></td>
<td>8.0 m</td>
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<tr>
<td></td>
<td></td>
<td>Wackestones and packstones, nodular bedded with bioclasts, peloids, ooids and terrigenous material. Some intraclasts and pebbles, interbeds of calcareous sandstones and shales-siltstones.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interbedded shales and very thin-bedded fine sandstones. Single sets of small-scale cross-bedding occasional.</td>
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<tr>
<td></td>
<td></td>
<td>3.0 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sandstones, soft, friable, medium-to fine-grained &amp; thin-bedded. Large-scale planar cross-bedding, hummocky cross-bedding, and occasional parallel laminations. Some interbeds of shales.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shales</td>
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<tr>
<td></td>
<td></td>
<td>9.0 m</td>
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<tr>
<td></td>
<td></td>
<td>Sandstones, soft, friable, fine-grained, large-scale planar cross-bedded. Shale pebbles common.</td>
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<tr>
<td></td>
<td></td>
<td>6.0 m</td>
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<tr>
<td></td>
<td></td>
<td>Shales with occasional interbeds of bioturbated siltstone and fine sandstone.</td>
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<tr>
<td></td>
<td></td>
<td>4.5 m</td>
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<td></td>
<td>Sandstones, soft, friable, fine-grained, large-scale planar cross-bedded, occasionally thinly-laminated. Shale pebbles common.</td>
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Fig. 7 Measured stratigraphic section C of the Fort Member.
11°. Thin laminations are occasionally present. Very small, rounded, shale pebbles of olive coloured are common.

The overlying 6 metres include olive shales with occasional interbeds of siltstones and fine sandstones. Shales are mostly covered and weathered. Siltstones and fine sandstones are friable, soft and yellow and grey coloured, and appear black and brown coloured on weathered surfaces. They occur in upto 22 cm thick bioturbated beds showing irregular bedding.

The above described 6 m thick olive shales are overlain by 9 metres of pale yellow and grey coloured, fine sandstones. The sandstones are soft and friable but slightly harder towards the top of the sequence. Large-scale planar cross-bedding is present throughout the sequence. Inclination of foresets of cross-bedding ranges from 4° to 20°, averaging 16°. Olive coloured, rounded shale pebbles of very small size are common throughout the sequence.

Next 1.5 metres comprise olive coloured shales which are weathered and mostly covered with scree.

The overlying 3 metres consist of medium-to fine-grained sandstones with interbeds of olive coloured shales. The sandstones are soft and friable, yellow, grey and purple coloured, and appear rusty brown and purple black on weathered surfaces. They are thin-bedded occurring in 15 cm to 30 cm thick beds and show wavy bedding. Large-scale
planar cross-bedding is present. The bounding surfaces of cross-sets are planar as well as wavy. The latter resemble hummocky cross-bedding (Harms et al., 1975). The inclination of foresets of cross-bedding ranges from 5° to 30°, averaging 14°. Some parallel laminations are also present. Olive shales occur in 20 cm to 30 cm thick beds.

The overlying 1.5 metres comprise interbedded shales and fine sandstones of olive green colour. Sandstones are very thin-bedded occurring in upto 4 cm thick beds. Single sets of small-scale planar cross-bedding are occasionally present.

The overlying 8 m thick sequence consists of nodular bedded limestones interbedded with calcareous sandstones and shales-siltstones. The nodular limestones are yellow, golden yellow and yellowish-brown coloured appearing generally purple to rusty brown on weathered surfaces. The nodular limestones comprise wackestones and packstones containing abundant micrite, microbioclasts, bioclasts, and peloids. Towards the top of the sequence well rounded bioclasts, and ooids become common. Some intraclasts are also present towards the top. The nodular limestones show alternating hard and soft laminae. The harder laminae are rich in terrigenous material and the softer are rich in micrite, in the lower part some beds, upto 20 cm thick, are so rich in terrigenous material that they form calcareous sandstones which are yellow coloured, and rusty brown coloured on weathered surfaces.
The nodular limestones occur in 13 cm to 40 cm thick bedsets in which bedding is not apparent because of their nodular and irregular, wavy nature. The bedding where discernable is 6.5 cm to 15 cm thick. Leached fossils have left behind cavities. Pebbles occur on the top.

Section D

The basal 15 m thick part of the sequence comprises soft and friable fine sandstones with thin interbeds of olive shales (Fig. 8). Sandstones are pale yellow and grey coloured, but appear purple, black and rusty brown on weathering. Sandstones are thin-bedded and occur in upto 65 cm thick bedsets. Sedimentary structures include large-scale planar cross-bedding, parallel laminations, ripple cross-laminations, and occasional ripple marks of both asymmetrical and symmetrical types. Planar cross-bedding occurs throughout the sequence. The inclination of foresets generally ranges from 3° to 28°, averaging 13°. Symmetrical ripple marks with flat crests and asymmetrical ripple marks are exposed on the upper bedding surfaces. Ripple cross-laminations are exposed towards the top of the sequence. The interbedded olive coloured shales occur in upto 20 cm thick beds. On the top of this sequence a 16.5 cm thick, hard, yellow, calcareous sandstone occurs with few fossil fragments. The calcareous sandstone shows wavy bedding. Olive coloured shale pebbles are common which are very small in size and well rounded. Vertical burrows are common.
3.0 m

Siltstone - wackestones with common blastoids, pebbles and occasional terrestrially derived. Occasional interbed of calcareous sandstone - wavy, nodular-beded furnes occasional.

8.0 m

Shales - weathered and mostly covered. In the lower part interbeds of fossiliferous calcareous sandstone showing wavy, hummocky bedding and planar cross-bedding. In the upper part nodular-beded bioclastic - tidal packstones.

6.5 m

Sandstones - silt, friable, fine-grained, thin-beded, planar cross-beded and burrowed.

4.5 m

Shales, weathered and mostly covered.

15.0 m

Sandstones - silt, friable, fine-grained, thin-beded, planar cross-beded, parallel laminated and ripple-cross-laminated. Interbeds of silt and shale pebbles. Wavy-beded, fossiliferous sandstones at the top.

Fig. 6 Measured stratigraphic section D of the Fort Num. 2.
The overlying 4.5 metres comprise olive coloured shales which are weathered and mostly covered with scree.

The next 4.5 metres consist of soft and friable fine sandstones which are pale yellow and grey coloured. The sandstones are thin-bedded and show large-scale planar cross-bedding. The thicknesses of beds and sets of cross-bedding range from 7 cm to 12 cm. Inclination of foresets generally ranges from 4° to 17°, averaging 14°. Vertical burrows are also common.

The overlying 8 metres include mainly shales (70%) interbedded with calcareous fine sandstones (18%) and nodular bedded limestones (12%). Shales are olive coloured, weathered and mostly covered. The sequence is thin-bedded and the various lithologies occur in 9 cm to 45 cm thick beds. Calcareous fine sandstones form harder beds. They are yellow coloured, and rusty brown on weathered surfaces with few fossil fragments. The sandstones show wavy or hummocky bedding and large-scale planar cross-bedding. Dip angles of foresets of cross-bedding range from 7° to 16°. The nodular limestones are yellow coloured and occur in 1 cm to 4 cm thick beds showing wavy and nodular bedding. They consist of peloidal packstone with bioclastic debris showing size grading of peloids.

The next sequence comprises 3 m thick yellow and pinkish yellow coloured mainly nodular limestones and
occasional calcareous sandstones. The limestones comprise mostly peloidal bioclastic packstones-wackestones and occasionally terrigenous bioclastic packstones. The limestones occur in 22 cm to 40 cm thick bedsets in which the thicknesses of individual beds range from 2.5 cm to 15 cm, averaging 8 cm. The limestones show wavy and nodular bedding. Burrows are occasionally present and leached fossils have left behind cavities.

Section E

The lowermost 10.5 m thick part of the sequence comprises mainly pale yellow, greyish-white and purple sandstones, generally fine to occasionally medium grained with occasional interbeds of pale yellow and grey shales-siltstones (Fig. 9). The sandstones are generally soft and friable but occasionally harder beds with greater amount of cementation occur which stand but on weathering. On weathered surfaces the sandstones appear black coloured. The sandstones are thin-bedded; thicknesses of beds range from 22 cm to 47 cm, and average 34 cm. The bedding types include large-scale cross bedding of planar and trough types, ripple cross-laminations and 2 cm to 15 cm thick bedsets of evenly laminated sand with low-angled discordances. However, the bedding is generally irregular due to bioturbation. Planar cross bedding occurs in single sets and wedge-shaped cosets. The bounding surfaces of cross-bedding sets are planar and wavy. The latter resembles hummocky bedding. The thicknesses of cross-bedding sets range from 2.5 cm to
<table>
<thead>
<tr>
<th>BEDDING AND SEDIMENTARY STRUCTURES</th>
<th>ROCK TYPE</th>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>5.0m</td>
<td>Grainstones with bioclasts, ooids and scattered terrigenous grains. Wavy bedded and large-scale planar and trough cross-bedded. Occasional interbeds of nodular bedded, bioturbated, wackestone-packstone.</td>
<td></td>
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<tr>
<td>10.0m</td>
<td>Wackestones and packstones, nodular bedded, with bioclasts, whole fossils, peloids, and terrigenous grains. Calcareous sandstone interbeds.</td>
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<tr>
<td>3.0m</td>
<td>Calcareous shales with fine sandstone interbeds.</td>
<td></td>
</tr>
<tr>
<td>1.5m</td>
<td>Sandstones, soft, friable, fine-grained, bioturbated, large-scale planar and trough cross-bedded.</td>
<td></td>
</tr>
<tr>
<td>3.0m</td>
<td>Shales, mostly covered.</td>
<td></td>
</tr>
<tr>
<td>10.5m</td>
<td>Sandstones, soft, friable, fine-to medium-grained, thin-bedded, bioturbated large-scale planar and trough cross-bedding, bedsets of laminations with low angled discordances, hummocky cross-bedding, ripple cross-laminations. Shale pebbles common, interbeds of shale-siltstone.</td>
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Fig. 9 Measured stratigraphic section E of the Fort Member.
16.5 cm, and average 8 cm. The inclinations of planar foresets range generally from 1° to 25°, and average 12°. The bedding surfaces show asymmetrical ripple marks and occasional rhomboidal ripple marks. Asymmetrical ripple marks are of small scale with wave lengths ranging from 2.5 cm to 4 cm and averaging 3.5 cm. They show deposition of mud on the lee side. Their crests are straight and flat. Very small, rounded olive shale pebbles are common. Burrows are also common.

Next is a 3 m thick sequence of mainly olive coloured shales which are weathered and mostly covered with scree.

The overlying 1.5 m thick pale yellow, fine sandstones are soft and friable. In general the sandstones show irregular and disturbed bedding as a result of bioturbation. Large-scale planar and trough cross-bedding also occur.

The next 3 metres comprise pale yellow calcareous shales with occasional 15 cm to 25 cm thick interbeds of fine sandstones. The shales are weathered and mostly covered.

The next 10 metres include pale yellow, fossiliferous nodular limestones with occasional interbeds of medium-grained calcareous sandstones. The limestones occur in alternate soft and hard bands of micritic limestones and arenaceous limestones. The limestones comprise wackestones and packstones with bioclasts, peloids, and terrigenous admixture. Bioclasts are represented by fossil fragments
as well as whole fossils. The bedding is nodular, wavy and irregular. The top 1 m thick part consists of brownish-yellow, richly fossiliferous limestones (packstones) occurring in 20 cm to 50 cm thick bedsets. Cavities left behind by leached fossils are present.

The nodular limestones are overlain by 5 m thick, yellow golden yellow and yellowish-brown limestones which form hard and resistant bands. This sequence can be divided into lower-3.5 m thick wavy bedded limestones and upper - 1.5 m thick cross-bedded limestones. The wavy bedded limestones comprise grainstones with abundant rounded bioclasts and some ooids. Their bedding thicknesses range from 2 cm to 5 cm and average 3 cm. Terrigenous material occurs as scattered grains. The upper 60 cm thick part of wavy bedded limestones consists of richly fossiliferous and burrowed nodular limestones (packstones) with a 6 cm thick bed of homogeneous lime mudstone with few bioclasts. The bedding thicknesses in richly fossiliferous nodular limestones range from 7 cm to 18 cm. The upper 1.5 m thick cross-bedded limestones capping the scarp comprise bioclastic-ooidal grainstones with occasional thin interbeds of nodular limestones (wackestones). The thicknesses of beds range from 13 cm to 35 cm and average 21 cm. The cross-bedding includes both large-scale planar and trough types. The thicknesses of cross-bedding sets range from 6 cm to 19 cm and average 13 cm. Fossils are concentrated along the foresets of cross-bedding and also in some beds upto 25 cm thick.
Section F

The basal 8.5 metres of the sequence comprise light grey, yellow and light purple, fine to very fine grained, soft and friable sandstones showing black patches and purple colour on weathered surfaces (Fig. 10). In the upper part, the sandstones are mostly very fine grained, compact and hard with thin intercalations of olive coloured shales. The sandstones are thin-bedded; the thicknesses of beds range up to 30 cm. They show wavy or hummocky bedding, cross-bedding and occasional parallel laminations. Cross-bedding of both planar and trough types is present but the latter is abundant. The thicknesses of cross-bedding sets range from 3 cm to 21 cm and average 8 cm. Burrowing is common and has resulted in irregular bedding.

The overlying 3.5 m thick sequence comprises shales of pale yellow to olive colour appearing rusty brown on weathered surfaces. Thin interbeds of pale yellow, friable fine sandstones, occasionally occurring in the sequence, show thin and irregular bedding. The sequence is topped by a 30 cm thick, hard, pale yellow, cross-bedded calcareous sandstone with few bioclasts. Burrowing is common.

The overlying 6 m thick shales contain occasional interbeds of pale yellow arenaceous micritic limestones. The limestones are pelletal and bioclastic wackestones-packstones and occur in 30 cm thick beds showing nodular bedding and burrowing.
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<th>m</th>
<th>BEDDING AND SEDIMENTARY STRUCTURES</th>
<th>ROCK TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 m</td>
<td>Packstones - grainstones, cross-bedded, terrigenous material, pellets, bioclasts, and some ooids.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 m</td>
<td>Wackestones - packstones, nodular bedded and burrowed, with pellets, pellets, microbioclasts, and terrigenous grains, interbeds of calcareous shales-siltstones.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 m</td>
<td>Shales with occasional interbeds of nodular bedded and burrowed wackestones - packstones containing pellets and bioclasts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 m</td>
<td>Shales with thin interbeds of burrowed fine sandstones. A 30 cm thick cross-bedded, fossiliferous calcareous sandstones at the top.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.5 m</td>
<td>Sandstones, soft, friable, fine to very fine-grained, thin-bedded, wavy or hummocky bedding, cross-bedding and parallel laminations. Abundant trough cross-bedding. Thin olive shale intercalations towards the top. Burrows common.</td>
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Fig. 10 Measured stratigraphic section F of the Fort Member.
The next 6 metres include interbedded pale yellow nodular arenaceous micritic limestones (60%) and pale yellow to olive coloured calcareous shales-siltstones (40%). The limestones comprise pelletal, peloidal and microbioclastic wackestones-packstones containing terrigenous sand grains. They occur in 10 cm to 60 cm thick bedsets which show wavy and irregular bedding, and bioturbation. The nodular limestone beds are harder and more resistant to weathering than the interbedded calcareous shales-siltstones. The latter occur in 50 cm to 1.3 m thick interbeds showing irregular bedding.

Capping the scarp is a 50 cm thick yellowish-brown, poorly fossiliferous arenaceous limestone. This is very hard and cross-bedded comprising arenaceous, peloidal and bioclastic packstone-grainstone with some ooids. Bioclasts are well rounded, elongated and of small size.

Section G

The lower, 3 m thick part of the sequence comprises light grey to pale yellow, friable, soft and micaceous fine sandstones and occasionally medium sandstones which appear black on weathered surfaces (Fig. 11). Irregular bedding and burrows are common. Large-scale planar and trough cross-bedding occurs throughout the sequence. Dip angles of cross-bedding foresets range generally from 4° to 25° and rarely to 34°, and average 14°. Very small, rounded and olive coloured shale pebbles are common.
2.0 m
Grainstones and packstones with bioclasts, peloids, ooids, and some terrigenous grains. Wavy or large-scale planar and trough cross-beding in grainstones. Nodular bedding and burrows common in packstones.

1.5 m
Wackestones-packstones, nodular bedded, with ooids, peloids, bioclasts, and some terrigenous grains. Burrows common.

4.5 m
Calcereous fine sandstones with few bioclasts. Bioturbation, common.

6.0 m
Shales, mostly covered.

3.0 m
Sandstones, soft, friable, fine-to medium-grained. Large-scale planar and trough cross-bedded. Shale pebbles and burrows common.

Fig. 11 Measured stratigraphic section 8 of the Fort Member.
Next are 6 m thick shales which are weathered and mostly covered. The shales show rusty brown, purple and yellow coloured bands which are upto 2.5 cm in thickness.

The overlying 4.5 metres include pale yellow, calcareous fine sandstones. The harder, and resistant, well cemented sandstones outcrop but the rest are mostly weathered and covered. The sandstones show irregular bedding due to bioturbation and contain few bioclasts.

The overlying 1.5 m thick yellow to yellowish-brown, nodular fossiliferous limestones comprise wackestones and packstones with ooids, peloids, bioclasts, and some terrigenous grains. They occur in 25 cm to 50 cm thick bedsets in which thicknesses of individual beds range from 3 cm to 20 cm, averaging 11 cm. They show alternate harder and softer beds with nodular and wavy bedding. Burrowing, and upto 7 cm long leached fossil cavities are common. A 10 cm thick yellow micritic limestone (silty pelletal wackestone) forms the top of the sequence.

The next 2 metres consist of yellow to yellowish-brown fossiliferous limestones (grainstones and packstones) containing bioclasts, peloids and ooids, and some sparsely distributed terrigenous grains. The limestones occur in 40 cm to 60 cm thick bedsets in which thicknesses of individual beds range from 1 cm to 20 cm, averaging 8 cm. The lower half of the sequence consists of alternating harder grainstone beds and softer nodular packstone beds.
The upper half is mainly composed of hard grainstone beds, alternatingly rich and poor in fossils. The bands rich in fossils are 8 cm to 15 cm thick. The nodular packstone beds are characterised by burrowing and absence of cross-bedding. The grainstone show either wavy bedding or cross-bedding. Cross-bedding is of large-scale planar and trough types. The thicknesses of cross-bedding sets range from 5 cm to 15 cm, averaging 9 cm. Cross-bedding is more abundant in the upper part of the sequence.

**BADA BAGH MEMBER**

A stratigraphic section of the Bada Bagh Member (Fig. 12) was measured in the scarp situated near Bada Bagh village (Plate III, Fig. A). This 18 m thick sequence consists of peloidal grainstones, intraclastic grainstones, bioclastic grainstones and ooidal grainstones with interbeds of calcareous sandstones (Plate III, Fig. B). The colour of the rocks is generally yellow to golden yellow, but rusty brown to buff on weathered surfaces. The sequence is thin-bedded; thicknesses of beds range from 5 cm to 21 cm. The intraclastic grainstones occur as intraformational beds of irregular thicknesses in peloidal grainstones and bioclastic grainstones in the lower part of the sequence. Terrigenous material is abundant throughout the sequence.

The bedding types and sedimentary structures of grainstones and calcareous sandstones include wavy bedding, large-scale cross-bedding, ripple cross-laminations, bedsets
DESCRIPTION

18.0 m

Peloidal grainstones, intraclastic grainstones, bioclastic grainstones, and ooidal grainstones with calcareous sandstone interbeds and occasional peloidal packstone. Intraclastic grainstones (intraformational bands) common in the lower part. Terrigenous material abundant; fossil fragments and whole fossils common. Lithoclasts also present.


Fig. 12 Measured stratigraphic section of the Bada Bagh Member.
of even laminae with low-angled discordances, and ripple marks (Plate III, Fig. C). The large-scale cross-bedding is both planar and trough types (Plate III, Fig. D) and generally occurs in cosets. The thicknesses of cross-bedding sets range from 4 cm to 16 cm. Dip angles of planar foresets range from 2° to 32°. Herringbone cross-bedding is occasionally seen in peloidal grainstones. The cross-bedding sets are generally wedge-shaped. Ripple cross-laminations occur in some very thin to thin beds which are 4 cm to 6.2 cm thick. Asymmetrical ripple marks with wavy and sharp crests and some interference ripple marks are also present. Trough foresets show concentration of fossils. Burrows are common in calcareous sandstone interbeds and in the upper part of the sequence.

Peloids, ooids, fossil fragments, whole fossils and intraclasts are distributed throughout the sequence. Peloids and ooids are of silt and fine sand size and ovoid to spherical in shape. Cavities left behind by leached ooids, herein called as 'oolicasts', are abundant in ooidal grainstones and are similar to ooids in size and shape. Fossil fragments and whole fossils are common throughout the sequence but are predominant in bioclastic grainstones. They are represented by brachiopods, gastropods, pelecypods, echinoderms, ostracods and foraminifers. Size of whole fossils ranges from 2.6 cm to 6.3 cm. The shell cavities have been filled with ferruginous silty micrite. Tear-shaped molluscan micritic infillings of small size and yellow colour
PLATE III

Photographs showing lithologic and sedimentary characters of the Bada Bagh Member and the Kuldhar Member

Figure A. A general view of the Bada Bagh Scarp. Grainstones are exposed in the foreground as well as in the scarp.

Figure B. Laminated peloidal grainstones overlain by intraclastic grainstones showing cavities left behind by the removal of soft intraclasts, Bada Bagh Member.

Figure C. Cross-bedding and bedsets of laminae with low angled discordances in grainstones of the Bada Bagh Member.

Figure D. Large-scale trough cross-bedding in peloidal grainstones of the Bada Bagh Member. Trough cross-bedding is overlain by an intraclastic bed with scoured base (demarcated by broken line on photograph).

Figure E. Wavy bedding due to rippling in packstones-grainstones of the Kuldhar Member.
are common. In intraclastic grainstones intraclasts are oriented mostly parallel, and sometimes oblique to the bedding. Their size, shape, and composition are highly variable. They are generally elongated, oval to occasionally equidimensional, rounded, and very small to large in size which ranges from 0.3 cm to 23.5 cm. The intraclasts are pale yellow in colour and composed of lime mudstone, bioclastic wackestone-packstone and calcareous fine sandstones. Amount of intraclasts increases towards the top of intraclastic grainstone beds.

KULDHAR MEMBER

A stratigraphic section of the Kuldhar Member (Fig. 13) was measured in the river cutting near Kuldhar village. The basal 2.5 m thick sequence consists of poorly fossiliferous arenaceous limestones interbedded with fossiliferous limestones. The colour of the rocks is golden yellow, brownish yellow and buff, but rusty brown on weathered surfaces. The limestones mainly comprise coarse bioclastic packstones-grainstones and occasional wackestones. The thicknesses of beds range from 12 cm to 48 cm.

Bedding types and sedimentary structures include wavy bedding (Plate III, Fig. E), large-scale cross-bedding ripple-cross-laminations and asymmetrical ripple marks. Cross-bedding is of planar and trough type but the latter type is abundant. The ripple crests are rounded and undulating. Ripple-cross-laminations are exposed in the lower as well as
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<th>BEDDING AND SEDIMENTARY STRUCTURES</th>
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<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>2.0m</td>
<td>Packstones-wackestones with abundant whole fossils. Some ooids, peloids and intraclasts. Irregular and wavy bedding. Biofouling common.</td>
<td></td>
</tr>
<tr>
<td>1.5m</td>
<td>Weathered, grey and earthy coloured massive-clay. Irregular and nodular bedding.</td>
<td></td>
</tr>
<tr>
<td>1.0m</td>
<td>Packstones &amp; wackestones with abundant pellets and fossil fragments. Ooids common and some intraclasts. Whole fossils abundant towards top. Irregular and wavy bedding.</td>
<td></td>
</tr>
<tr>
<td>2.5m</td>
<td>Coarse bioclastic packstones-grainstones with occasional interbeds of wackestones. Fossil fragments abundant. Some whole fossils. Terrigenous material, ooids and peloids common. Wavy bedding and large-scale cross bedding. Trough type common than the planar type. Micro-cross laminations.</td>
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</table>

Fig. 13 Measured stratigraphic section of the Kuldhar Member.
upper parts of the sequence.

Fossils include mainly fragments and some whole fossils of brachiopods, echinoderms, molluscs and foraminifers. Their amount and size increase towards the top of the sequence. Ooids and peloids are spherical to ovoid, and yellow in colour. 'Ooliclasts' and 'pellcasts', cavities left behind after removal of ooids and peloids are observed.

The overlying 1 m thick sequence consists of yellow, dark yellow and golden yellow fossiliferous limestones and pelletal limestones appearing rusty brown on weathered surfaces. The limestones comprise mainly packstones and wackestones with abundant pellets and bioclasts, common ooids and some intraclasts. The limestones occur in alternate hard and soft beds which are 7 cm to 23 cm thick. Bedding is irregular and nodular. Fossils are mostly of large size and include both fragments and whole fossils but the latter are abundant towards the top of the sequence. Fossils belong to brachiopods, echinoderms, belemnites, ammonites and pelecypods, and occasional bryozoans. Shell cavities have been filled with pelmicrite. Fossil molds and casts are common and range in size upto 6 cm. Leached ooids and pellets are represented by 'oolicasts' and 'pellcasts'. Branched horizontal burrows upto 2 mm in diameter are also exposed on the upper bedding surfaces. These burrows have been filled with ferruginous micrite.

The overlying 1.5 metres comprise grey and earthy
coloured claystone which is overlain by 2 m thick, yellow and buff coloured fossiliferous limestones. The limestones comprise packstones-wackestones with abundant whole fossils, and some ooids, peloids and intraclasts. Whole fossils are represented by brachiopods, ammonites, belomnites, pelecypods and gastropods. Fragments of echinoderms are also present. The limestones are mostly weathered showing irregular and wavy bedding.