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The Sedimentology and Sequence Stratigraphy of Early Cambrian Kussak Formation, Salt Range Pakistan.

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Introduction

Early Middle Cambrian Sandstone from Nilawahan Gorge and Khewra Gorge (Pakistan) has been studied from Sedimentological and sequence stratigraphic point of view.

There are about eleven lithofacies/ subfacies.

The Kussak Formation has several sandstone, siltstone, claystone, sandy dolomite and mudstone. Eleven lithofacies are observed in the Kussak Formation and these are arranged in several distinctive fining upward cycles. Coarse grained laminated sandstone C_L , Medium grained laminated sandstone M_L , Medium grained massive sandstone M_M , Fine grained laminated sandstone F_L , Fine grained massive bedded sandstone F_M , Fine grained bioturbated sandstone F_B , Fine grained flaser bedded sandstone F_F , Sandy dolomite S_D , Bioturbated mudstone B_M , Laminated claystone Z , Bioturbated siltstone and claystone Z_B .

The presence of Hummocky Cross Stratification indicates large storm in which large amount of water was pushed on a tidal flat. Large scale cross stratification indicates on shallow tidal flats having storm surges and tidal currents. Presence of ripple cross lamination and oscillatory ripple marks shallow water conditions. The complicated pattern of oscillatory ripple marks show deposition in a changing depth tidal flat environment. Mudcracks indicates supratidal conditions. Pseudonodules show that the beds are disconnected.

The Kussak Sandstone exhibits a variety of sedimentary structure which gives information about the depositional environment of the formation. The most common sedimentary structure in the formation is bedding, cross bedding, ripples mark, mudcracks, bioturbation, and iron-nodules. The bedding of the formation is thin to thick.

The Kussak formation exhibits fining upward sequence and shows cyclic deposition in the base. At the top of the succession medium grained sandstone with shale intercalations is present. Silt and claystone intercalations are present through-out the succession.

Most of the classifications of sandstone are based on the three end members Quartz, Feldspar and Lithic fragments and known as QFL diagram. The thin section study of Kussak Formation was carried out and the percentages of detrital grains of quartz, feldspar and rock fragment are plotted on QFL diagram. The sandstone contains about 85-86% quartz, 3-4% feldspar and 1% rock fragment.

In Pettijohn (1975) classification of the sandstone, percentages of three framework grains quartz, feldspar and rock fragment are plotted on QFL diagram (Fig. 4.6a). In Folk (1974) classification of sandstone, percentages of quartz, feldspar and rock fragments are plotted on QFL diagram (Fig. 4.6b).

The percentages in 100% of three end members were calculated and plotted according to Folk (1974) and Pettijohn (1975) classification of sandstone. All samples of sandstone of the Kussak Formation belong to the category of quartz arenite in Folk (1974).

Theory

Facies analysis is an important part if any stratigraphic study. The basic idea is to recognize how different depositional environments are expressed by the development of characteristic structures, lithologies and organic components in sedimentary rocks. The usual way to reconstruct the depositional history of an area is to group strata into facies assemblages; that is measuring numerous stratigraphic sections, examining the rocks, and assigning those rocks a depositional environment based on sedimentary structures, paleontological evidence and lithology.

In our case, two sections of Early Cambrian were measured at Khewra and Nilawahan. The purpose was to identify the Lithofacies assemblage of the Cambrian sequence in studied area.

The Kussak Formation has several sandstone, siltstone, claystone, sandy dolomite and mudstone. Eleven lithofacies are observed in the Kussak Formation and these are arranged in several distinctive fining upward cycles. Mainly 11 facie are present in the Kussak Formation.

The example of the one section is given in the figure 1.

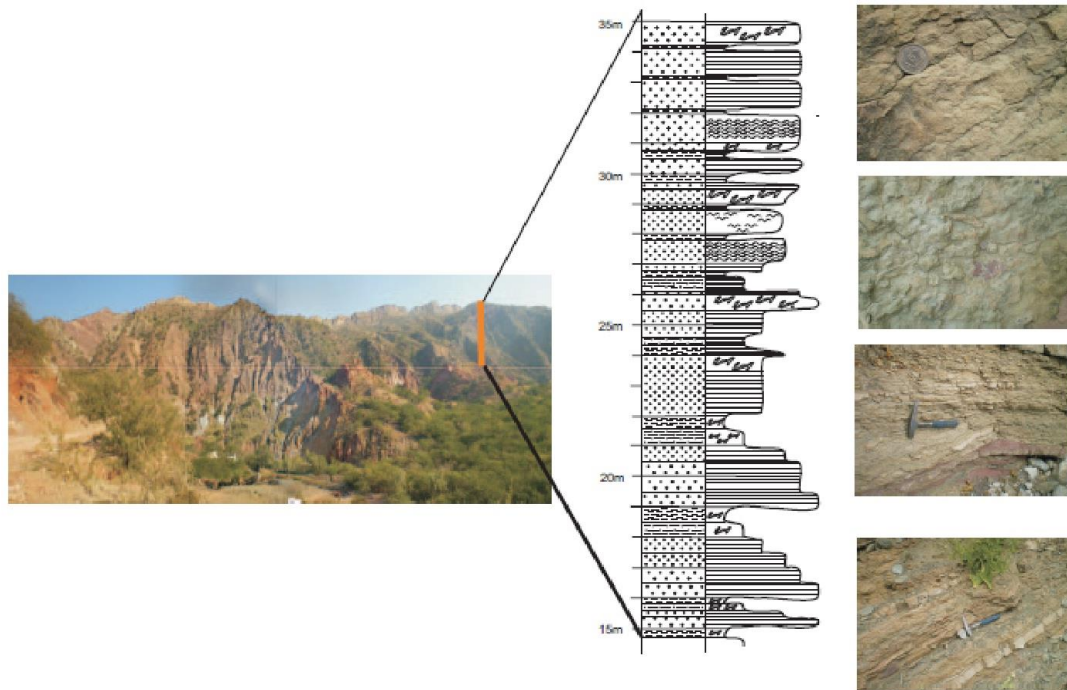


Figure 1. This panel diagram is showing the lithological log of the Kussak sandstone from the Nilawahan gorge, central salt range Pakistan.

Conclusions

The Kussak formation exhibits fining upward sequence and shows cyclic deposition in the base. At the top of the succession medium grained sandstone with shale intercalations is present. Silt and claystone intercalations are present through-out the succession. The Kussak Formation is meandering river to deltaic in origin and was deposited by a meandering river. This was determined from the facies pattern and architectural elements of the Kussak formation in the project area. The provenance studies of the Kussak Formation shows that its provenance was Arawali and melani ranges in the west of Pakistan. The sandstone is of sedimentary origin.

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