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SANDSTONE PETROGRAPHY OF GHAZIJ FORMATION OF DEGARI, KACH, MURREE BREWERY AND BIBI NANI AREAS, NORTHEAST BALUCHISTAN

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ABSTRACT

Sandstones of the Ghazij Formation are conspicuously rich in limestone, chert and basic igneous fragments and may be classified as calclithites and lithic arenites. These sandstones show marked contrasts, being particularly rich in basic igneous fragments (11 to 18%) in Murree Brewery and Kach areas and in limestone fragments (40 to 70%) in Degari and Bibi Nani areas. It is concluded that on the basis of contrasts in sandstone petrography the Ghazij Formation could further be subdivided into various members.

INTRODUCTION

The Ghazij Formation, which is exposed in the Axial Belt of Sulaiman Province of Baluchistan and Sind (29° 7′–31° N and 66° 5′–68° E), was initially described by Oldham (1890), Williams (1959), Eames (1952), Nagappa (1959) and Hunting Survey Corporation (1961) under various names. Williams (1959) designated the Spinthangi section and Hemphill and Kidwai (1973) the section exposed near Baska Village as the type sections of the formation. Attempts have been made to subdivide the formation into the Baska shale and Marap conglomerate members (Eames, 1952; Hemphill and Kidwai, 1973).

The formation consists dominantly of brownish grey, greenish grey and red calcareous shales interbedded with sandstones, conglomerate and occasional limestone beds. Sandstones are brownish grey and dark to light greenish grey, fine to coarse grained, very thin bedded in the lower part and medium to thick bedded in the middle and upper parts. Coal is also associated with the sandstones in the middle part. The conglomerate consists of poorly sorted and subrounded to rounded pebbles of the underlying older rock formations. In sandstone and conglomerate horizons various sedimentary structures like cross-bedding, deformation structures, load casts and sole marks may commonly be found. Attempts have been made to describe the stratigraphy (Kazmi, 1962), mega-fauna (Iqbal, 1970) and sedimentology (Kazi, 1968; Farshori and Ahmad, 1969) of the formation. The formation conformably overlies the Dungan Formation of Paleocene age and underlies the Kirther Formation of Eocene age. In the surrounding areas rocks of the Alozai Group/Shirinab Formation (Triassic), Chiltan Limestone/Loralai Limestone (Jurassic), Parh Group/Moro Formation (Cretaceous) and Dungen Formation (Palaeocene) are exposed.

Purpose of study

The purpose was to study the petrography, to classify the available sandstone samples and to determine the source area of the sandstone detritus. The samples were not collected according to a pre-planned programme, therefore, the results provide only a broad picture of the petrography and classification of the available samples and may not represent the character of the formation throughout Baluchistan. Systematic vertical and lateral variations will be studied later on.

MINERAL CONSTITUENTS

Thin section study of the sandstone samples revealed that mineral constituents are subordinate to the rock fragments which are mainly limestones and cherts. Among the minerals quartz and feldspar are most common. Biotite and muscovite are also present.

Quartz is the most abundant among the mineral constituents (0.4 to 14%) which is mostly angular to sub-angular. It is dominantly of the non-undulatory type, a character which may correspond to its volcanic origin (Blatt and Christie, 1963). Feldspar is subordinate to quartz (0 to 2.6%) and is mostly plagioclase and rarely orthoclase and perthite. The maximum extinction angle of plagioclase measured according to Michel Levey's method is between 8° and 20° indicating that it is mostly albite and/or oligoclase. This sodic nature of the plagioclase may be due to the process of albitization (Cummins, 1962). Biotite is very rare and reddish brown variety is recognizable. Some of the biotite has been chloritized. A few grains of muscovite were also found. Chlorite is the most common among the clay minerals which is mostly of bluish green, yellowish green and brownish green colour. It occurs as authigenic matrix between the grains and as alteration product of biotite, basic igneous fragments and other ?ferromagnesian minerals. Heavy minerals include mostly chrome spinel and a few tourmaline and apatite grains.

Cement is mainly calcite which ranges from 7% to 35%. Matrix includes clay minerals, micas and unidentifiable grains of sizes finer than silt. The amount of matrix in most samples is less than 4% and only two out of ten samples (Murree Brewery area) have more than 10% matrix out of which only a single sample can be classified as greywacke.

ROCK FRAGMENTS

Various types of igneous, sedimentary and metamorphic rock fragments were recognized (Table 1) among which limestone and chert were most abundent ranging variously from 12 to 98% and 3 to 60% respectively.

TABLE 1. LIST OF IDENTIFIED ROCK FRAGMENTS.

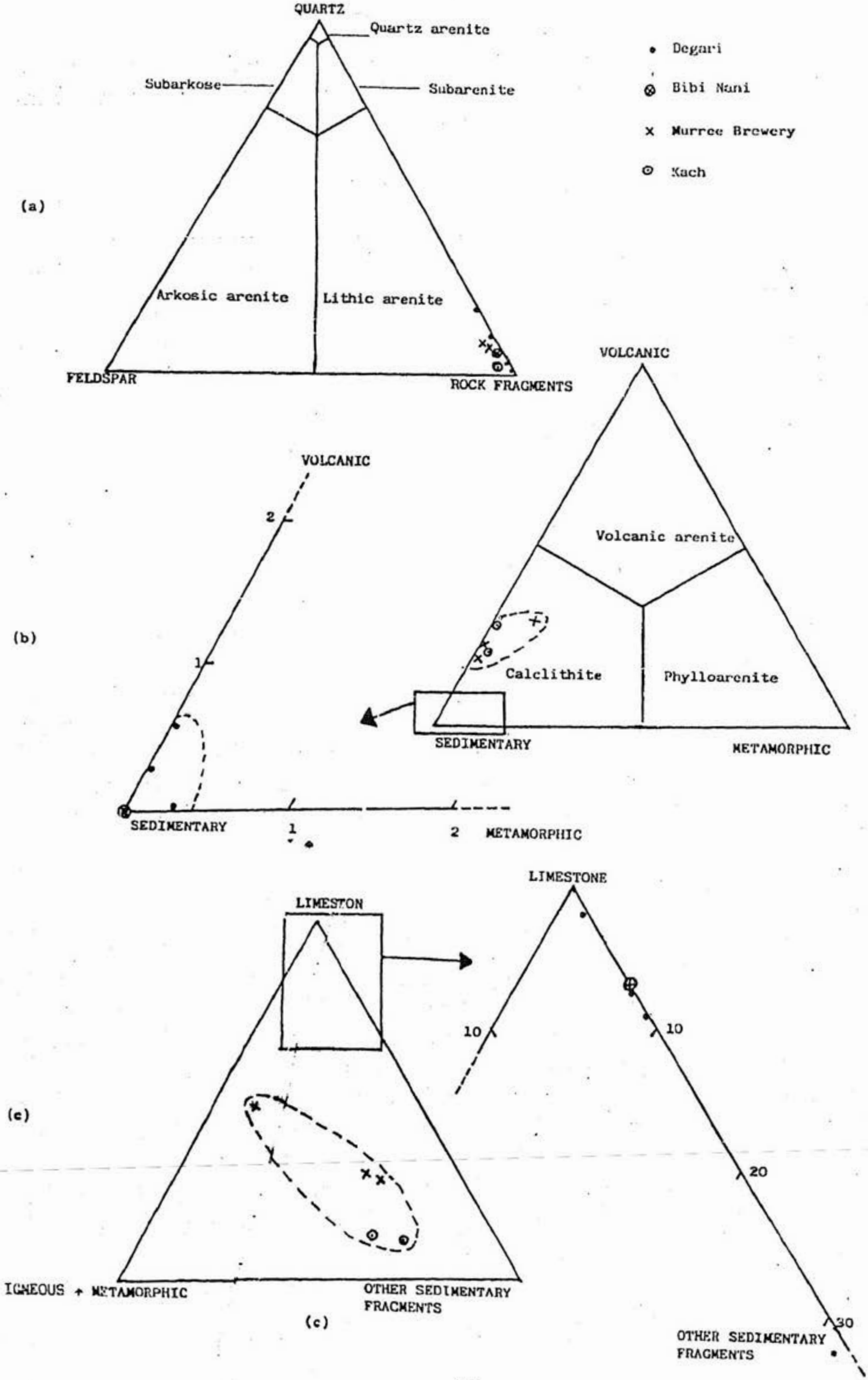
Igneous	Sedimentary	Metamorphic
Spilite	Limestone sparitic	Quartzite
?Diorite	Limestone micritic	Schist/phyllite
Granite	Calcareous fossil fragments	
	Red chert	
	Grey chert	
	?Marl	
	Sandstone	
	Siltstone	
	Shale	
	Carbonaceous matter	

The limestone fragments are of two main types —a dull, finely crystalline micritic type and a clear, coarsly crystalline and sparitic type. Also the chert fragments are of red and grey varieties which commonly contain spherical siliceous structures probably radiolaria. Among the igneous fragments those of basic volcanic rocks are more common. Dioritic and acidic igneous fragments are also rarely present. Metamorphic fragments include quartzite and a few schist/ phyllites.

RESULTS OF POINT COUNTING

Ten fresh and coarse grained sandstone specimens were selected for point counting among which four were from Degari area, three from Murree Brewery area, two from Kach area and a single one from Bibi Nani area. 500 points were counted in each specimen which have been considered to be significant enough for classifying a sandstone (Kassi, 1984). The acquired results were plotted on Quartz-Feldspar-Rock fragments triangular diagram (after Dott, 1964) and Volcanic-Sedimentary-Metamorphic triangular diagram (after Folk, 1968). The plots (Fig. 1) indicate that all the samples fall into the lithic arenite (Fig. 1a) and calclithite (Fig. 1b) fields. It may be observed that the sandstones of Degari area closely resemble those of Bibi Nani area (Fig. 1b–c) and are very rich in limestone and chert fragments. On the other hand, the sandstones of Murree Brewery and Kach areas are also rich in igneous and sedimentary fragments in addition to the limestone and chert fragments. A single sample from Murree Brewery area contains over 29% matrix and therefore corresponds to lithic greywacke.

Figure 1


QUARTZ
Quartz arenite
Subarkose
Subarenite
Degari
Bibi Nani
Murree Brewery
Kach
(a)
Arkosic arenite
Lithic arenite
FELDSPAR
ROCK FRAGMENTS
VOLCANIC
Volcanic arenite
Calclithite
Phylloarenite
SEDIMENTARY
METAMORPHIC
(b)
VOLCANIC
2
1
SEDIMENTARY
1
2
METAMORPHIC
LIMESTON
LIMESTONE
10
10
20
30
(c)
IGNEOUS + METAMORPHIC
OTHER SEDIMENTARY FRAGMENTS
(c)
OTHER SEDIMENTARY FRAGMENTS

NATURE OF THE SOURCE AREA

Genrally speaking the sandstones of the Ghazij Formation have been derived from a limestone dominated terrain in which various types of limestone formations may have been exposed. In addition basic igneous rocks were also exposed in the area. Other sedimentary fragments (mainly sandstones, siltstones and plant fragments etc.) are very subordinate and are intraformational. A few quartzite and schist/phyllite fragments were also found.

Two types of limestone fragments are recognizable: (a) A dul, fine grained and micritic variety which resembles the limestone of the Parh Group. Chert fragments especially those of red colour may also correspond to the Parh Group. Grey chert may have been derived from the Parh Group and/or from the Shirinab Formation of Jurassic age. (b) The coarsely crystalline, sparitic and fossiliferous limetsone fragments most probably correspond to the Dungen Limestone of Paleocene age. Fossil fragments may also have been derived from the same rocks. Jurassic rocks (the Chiltan Limestone and Shirinab Formation) could have also contributed to the limestone detritus.

In the sandstones of Murree Brewery and Kach areas in addition to the varieties of limestones just described, basic volcanic fragments are also very common. The scarcity of quartz coupled with its dominant non-undulatory nature also suggest a basic volcanic terrain — most probably the Bela Volcanic Group in the source area. This basic volcanic terrain, however was giving very minor proportion of detritus to the sandstones of Degari and Bibi Nani areas.

CONCLUSIONS

1) Sandstones of the Ghazij Formation are mostly the calclithite variety of lithic arenite.
2) These sandstones show marked contrasts in lithology and petrography, on the basis of which the Ghazij Formation may further be subdivided into various members.
3) The source area of the Ghazij Formation consisted dominantly of limestones and basic igneous rocks belonging most probably to the Parh Group and Bela Volcanic Group of Cretaceous and Dungen Formation of Paleocene age.

Fig. 1. (a) Results of point counting plotted on triangular diagram (Modified from Dott 1964).

(b) Results of point counting plotted on triangular diagram (Modified from Folk 1969). Corner of the sedimentary end member has been blown up to show appropriate positions of the samples from Bibi Nani and Degari area.

(c) Results of point counting plotted on triangular diagram to show the proportions of limestones to other sedimentary and igneous fragments. Corner of the limestone end member has been blown up to show appropriate positions of the samples from Bibi Nani and Degari area.

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REFERENCES

Blatt, H. & Christie, J.M., 1963. Undulatory extinction in quartz of igneous and metamorphic rocks and its significance in provenance studies of sedimentary rocks. J. Sed. Petrol. 33, 559—579.

Cummins, W.A., 1962. The greywacke problem. L'pool Manch'r. Geol. J. 3, 51—72.

Dott, R.H., Jr., 1964. Wacke, greywacke and matrix - What approach to immature sandstone classification? J. Sed. Petrol. 34, 625—632.

Eames, F.E., 1952. A contribution to the study of Eocene in Western Pakistan and Western India, part A. The geology of standard sections in the Western Punjab and in the Kohat District. Geol. Soc. Lond. Quart. Jour. 107, 159—172.

Farshori, M.Z. & Ahmad, M.R., 1969. Sedimentation in Ghazij Basin. Symp. Petrol. Inst. Pakistan, Jan. 1969.

Folk, R.L., 1968. Petrology of sedimentary rocks. Austin, Tex., Hemphills, 124 pp.

Hunting Survey Corporation Ltd., 1961. Reconnaissance geology of part of West Pakistan. Toronto, Canada.

Hemphill, W.R. & Kidwai, A.H., 1973. Stratigraphy of Bannu and Dera Ismail Khan areas, Pakistan. Prof. Paper, US Geol. Surv., 716—B. 36 p.

Iqbal, M.W.A., 1970. Mega-fauna from the Ghazij Formation (Lower Eocene) of Quetta-Sharigh area, West Pakistan. Mem. Geol. Serv. Pakistan. Palaeontologica Pakistanica 5.

Kassi, A.M., 1984. Lower Palaeozoic geology of the Gala area, Borders Region, Scotland. Thesis Ph.D. (unpubl.), Univ. St. Andrews, Scotland.

Kazi, A., 1968. Sedimentology of Ghazij Formation, Harnai, Baluchistan. Geol. Mag. 105, 35—45.

Kazmi, A.H., 1962. Stratigraphy of Ghazij Shales, Geologist 1. Geol. Soc. Karachi Univ.

Nagappa,Y., 1959. Foraminiferal biostratigraphy of the Cretaceous-Eocene succession in the Indo-Pakistan-Burma region. Micropalaeontology 5, 145—79.

Oldham, R.D., 1890. Report on the geology and economic resources of the country adjoining the Sind-Pishin railway between Sharigh and Spinthangi, and the country between it and Khattan. Indian Geol. Surv. Rec. 19 (2), 127—137.

Shah, S.M. (Ed.), 1977. Stratigraphy of Pakistan. Mem. Geol. Surv. Pakistan 12, 70 p.

Williams, M.D., 1959. Stratigraphy of the lower Indus Basin, West Pakistan. World Petrolium 5th Cong., New York, Proc., Sec. 1. Paper 19, 377—90.