

Occurrence and Origin of Gypsum Deposits at Jamsar and Pallu in Northwest Rajasthan

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Abstract Surface and near-surface Quaternary gypsum deposits of lacustrine and pedogenetic origins are abundant in northwest Rajasthan. The lacustrine forms are horizontally bedded gypsum deposits and pedogenetic crusts are massive, nodular and powdery pans. The lacustrine gypsum deposits are the locales of palaeolake basins and are in association with a serir surface. The pedogenetic gypsum pans occur in pockets along the palaeochannels, especially in the dune country. The influence of climatic variation and the control of tectonism are discussed on the basis of observations at Jamsar and Pallu in northwest Rajasthan.

Key words Quaternary gypsum, lacustrine, pedogenetic, palaeochannel

The Quaternary gypsum deposits of northwest Rajasthan occur at or near the surface as pedogenetic and lacustrine crusts. Barring the early mention of salt pans of northwest Rajasthan by Hacket (1880) and Heron (1917) and the preliminary work on genetic aspect by Auden (1952), Ghosh (1952) and Jacob *et al.* (1952), who opined that the gypsum deposits at Jamsar were precipitated from highly saline evaporating waters derived from nearby sources in lacustral depressions, there is little contribution on the gypsum deposits of northwest Rajasthan. In the present paper, the authors discuss the geomorphic controls, nature of occurrence and the possible origin of gypsum deposits at two sites in northwest Rajasthan.

Distribution and Mode of Occurrence

The Quaternary gypsum deposits of northwest Rajasthan, occurring as surface and shallow sub-surface crusts, are localised in lacustral basins associated with a serir surface or desert pavement, in fluvial leftout depressions, and/or aeolian deflation basins in the proximity of sand dunes. The known occurrences of gypsum deposits (Chandak 1978) are confined along the two linear trending tracts. One prominent NE-SW trending zone occurs in association with the transverse dunes and extends from Suratgarh in the northeast to Pugal in the southwest (Fig 1). Another tract of gypsum deposits, located along a flat, pebble or boulder

strewn and dune free upland tract (serir) extends from Jamsar in the northeast to Pokaran in the southwest. The pedogenetic crusts in the dune covered areas are massive, powdery, or nodular. The massive and powdery types are most abundant. The lacustrine gypsum deposits are composed of horizontally bedded gypsum deposits. In addition, hydromorphic crusts made of clusters of lenticular gypsum crystals in the form of rosettes (desert roses) occur in conjunction with pedogenic and lacustrine forms. Gypsum (selenite) crystals in pyramidal form occur with black clay deposits in the Lunkaransar lake.

Lacustrine Gypsum Deposit at Jamsar, Bikaner District

The gypsum deposit at Jamsar was studied earlier by Auden (1952), Ghosh (1952) and Jacob *et al.* (1952). It is located in a former lake basin. The basin forms a part of an upland with 'lag gravels', referred to as a desert pavement or a serir surface. The litho-assemblage of the gypsum deposits in the lake basin has three separate facies: the lower, horizontally bedded gypsum crystals, the middle intercalated sequence of clastic sediments, and the upper powdery calcrete (Table 1, Fig. 2). The lower gypsum bed occurs above a bed of fine to medium grained sand and represents lacustrine evaporites which presumably developed in a shallow water environment. The bed consists of graded gypsum crystals rang-

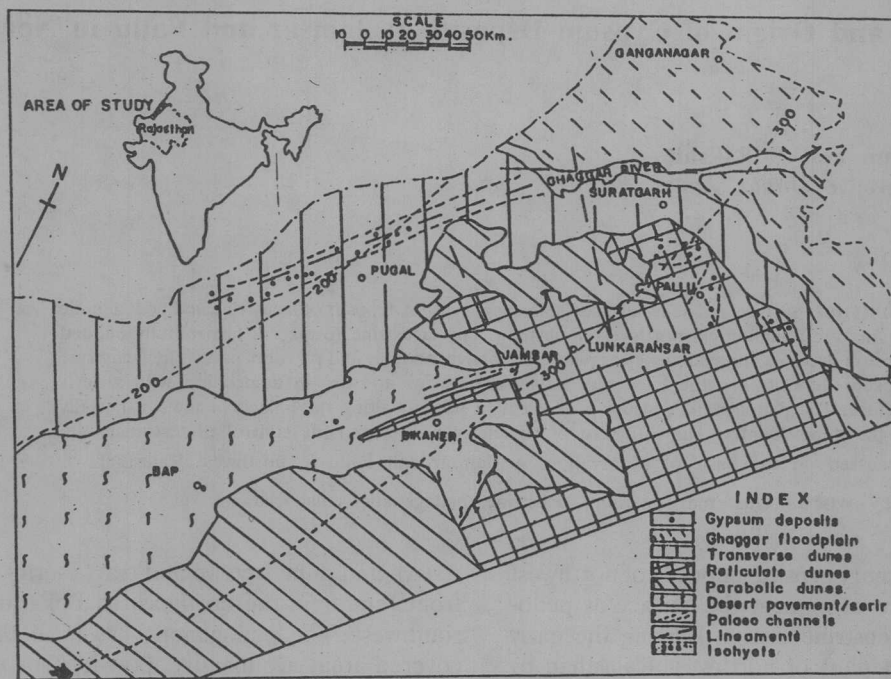


Fig 1 Occurrence of gypsum and geomorphic elements in northwest Rajasthan

ing in size from small (alabastrine crystallites) to large (0.5 cm in diameter) crystals. Free move-

ment of ions towards the nucleation sites favours unhindered growth of crystals of large size. The

Table 1 Lithoassemblage in Jamsar Lake

Facies	Depth	Lithology	Structure	Chemistry	Inference
Upper	0.0-2.0	Fine, powdery & friable calccrete	Massive	Abundance of calcium & acid insolubles (SiO ₂ & Al ₂ O ₃)	Dehydration and plugging of lake
	2.0-4.5	Brownish yellow, fine to coarse sand with gypsum (desert roses) crystals	Through & Planar cross beds	Abundance of acid insolubles, rich in calcium sulfate and poor in carbonates	Episodic sedimentation & evaporation
Middle	4.5-6.0	Intercalation of coarse sand with impure gypsum	-do-	-	-
Lower	6.0-9.0	Bedded gypsum ranging in size from fine (alabastrine crystals) to coarse (0.5 cm in diameter) crystals	-	Rich in calcium sulfate	-
	+9.0	Greenish grey fine to medium calcareous sand	Subcrop		-

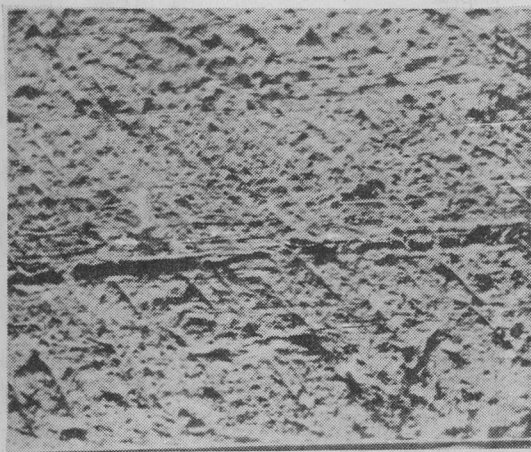


Fig 2 Bedded gypsum deposit, Jamsar, Bikaner enterolithic structures (Hussain & Warren 1989) and the pseudoanticlines, which are common in this sequence, indicate displacive crystallisation of gypsum. Initially the horizontal beds are contorted to accommodate volumetric expansion during the crystallisation and gives rise to slump structures. The middle sequence comprises the intercalation of clastic sediments and impure gypsum layers. The microfossils recovered from this sequence are *Valvulineria* sp. (Foraminifera), *Heterocypris* sp. *Bythocypris* sp. *Eucypris* sp. (Ostrocodes), *Viviparous* sp, *Menetus* sp (Gastropods), *Chara* sp. (Charophytes). Their presence suggests episodic shallow water sedimentation and evaporation. The massive and powdery calcrete at the uppermost sequence of the lake basin indicates final dehydration and plugging of the lake.

Pedogenetic Gypsum Near Pallu, Churu District

The gypsum deposit near Pallu is in the form of a massive, columniated buff-white coloured crust, overlying a fine to medium grained, yellowish green and calcareous sand (Fig. 3). Calcrete pan occurs along the peripheries of the gypsum deposit. The deposits, together, lie in a dune country. The gypsum deposits are the pedogenetic crusts of illuvial origin and are the exhumed products (Watson 1988). A continuous chain of

gypsum pockets in the area suggests the possibility of their location in depressions along a former drainage channel. One such linear chain of gypsum deposits occurs along a palaeochannel of the Saraswati river, traced by Ghose *et al.* (1979). Intermittent fluvial erosion and deposition in a dominantly aeolian country may also have played a role in determining the sites of the pans.

Discussion

The gypsum deposit in northwest Rajasthan are of lacustrine and pedogenetic origins. The bedded gypsum deposit associated with upland 'serir' tract at Jamsar has developed in an inland lake. The three subfacies in the lithosequence of the lake basin suggest alternate wet and dry climatic phases. Calcrete-gypsum crusts were formed during the transition of climate from humid to arid phase (Reeves 1970), while gypsum is indicative of extreme aridity (Watson 1988). Additionally, the lake is situated at the intersection of two lineaments (Bakliwal & Ramasamy 1982) which might have created the sink for the water from the surrounding catchment. The Sambhar lake in central Rajasthan also lies at the junction of two linears along which neotectonic movements were inferred (Das Sarma 1988).

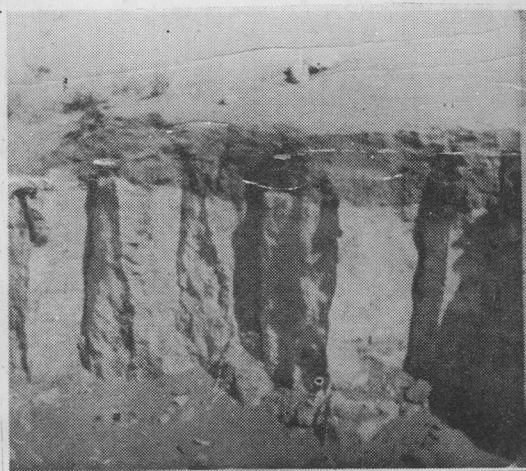


Fig 3 Pedogenetic gypsum deposit overlain by aeolian sand, Pallu, Churu

The pedogenetic crusts in the dune country near Pallu could be the exhumed products of illuviated material (Watson 1988). The occurrence of gypsum along well defined linear tracts suggests illuviation from shallow water bodies along some palaeochannel courses. These linearly trending tracts also fall along prominent lineaments and suggest that the palaeodrainage was tectonically controlled.

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