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ABSTRACTS

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El Instituto Tecnológico GeoMinero de España, ITGE, que incluye, entre otras, las atribuciones esenciales de un «Geological Survey of Spain», es un Organismo Autónomo de la Administración del Estado, adscrito al Ministerio de Industria y Energía, a través de la Secretaría General de la Energía y Recursos Minerales (R.D. 1270/1988, de 28 de octubre). Al mismo tiempo, la Ley de Fomento y Coordinación General de la Investigación Científica y Técnica lo reconoce como Organismo Público de Investigación. El ITGE fue creado en 1849.

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INDEX

GEOLOGY

INVITED CONFERENCES

SECTION I: SEDIMENTARY AND DIAGENETIC ENVIRONMENTS OF SILICEOUS ROCKS

SECTION II: PETROLOGY AND GEOCHEMISTRY OF SILICEOUS ROCKS, METHODS OF STUDY

CHERT IN BIOTURBATED SEDIMENTS OF SABKHA PALEOENVIRONMENT

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Introduction

The tertiary continental deposits of the Loranca Basin are divided into three stratigraphic units: "Unidad Detrítica Inferior", "Unidad Detrítica Superior" and "Unidad Terminal" (DIAZ-MOLINA, 1974; DIAZ-MOLINA et al., 1989).

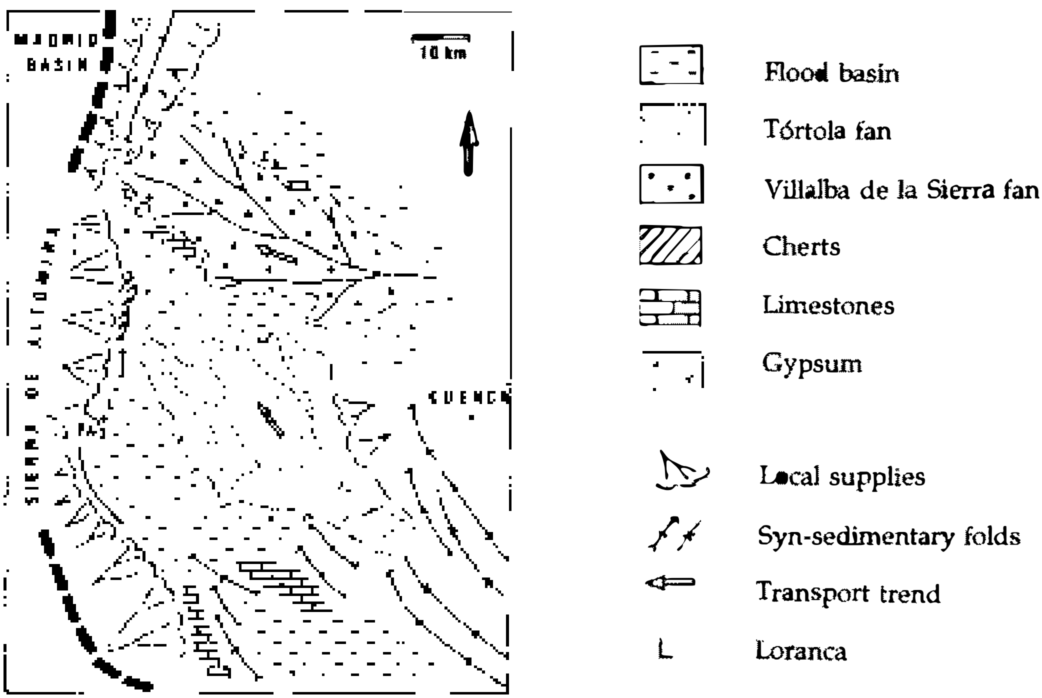

Figure 1

Three different stages can be distinguished in the "Unidad Detrítica Superior". The first corresponds to the most active time interval of the fans, when the Loranca Basin was connected to the Madrid Basin. During the following stage (Fig.1), syn-sedimentary folding started to plug the area connecting the Loranca Basin and the Madrid Basin, and local base levels were being established with development of wet areas. The last evolution is characterized by the dominance of gypsum deposits. Chert is a common feature in the stages 2 and 3 associated with gypsum deposits.

Sedimentology of gypsum deposits

Playa-lake environments developed during stages 2 and 3, including: (1) saline mud flat, (2) marginal lacustrine and (3) sait pan.

Saline mud flat consists of silty clays with lenticular gypsum crystals (Fig.2,D), powder gypsum (Fig.2,G) and gypsum with vertically aligned fabric (Fig.2,E). These facies present sequences formed by a lower interval of silty clays with gypsum crystals and an upper member of either powder gypsum or gypsum with vertical fabric. These deposits were associated to capillary evaporation processes (WARREN, 1982; ROSEN & WARREN, 1990).

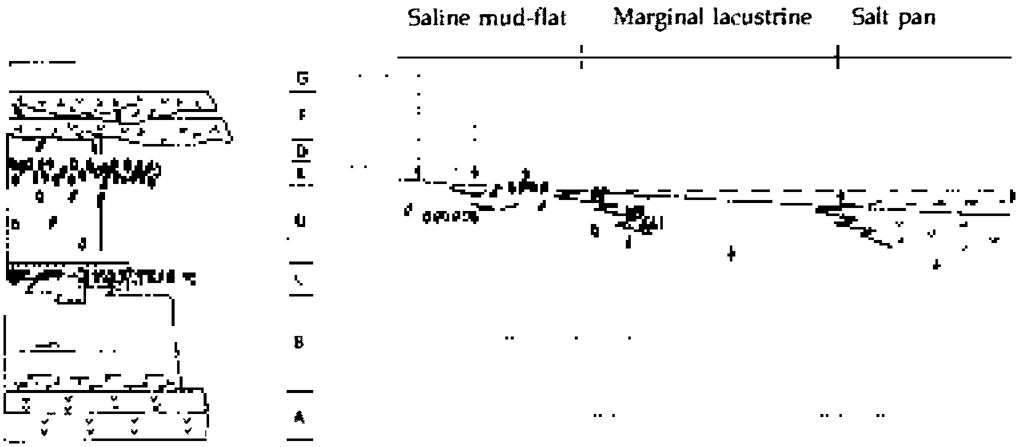

Figure 2

Marginal lacustrine is represented by interstitial gypsum facies: bioturbated microcrystalline gypsum, with or without cherts (Fig.2, B and C). Bioturbated microcrystalline gypsum facies superimposes vertically or interfingers with the external or inner lacustrine facies. Each bed can also reveals a sequence beginning with a micritic rich interval which evolves upwards to lenticular gypsum. The top of the bed exhibits subaerial features (bird eyes and mud cracks) which indicate that they are very shallow deposits.

Salt pan deposits consists of layered macrocrystalline gypsum deposits (Fig.2, A), showing an equant mosaic fabric of prismatic gypsum. These deposits formed by subaqueous growth from evaporating brines.

Detrital gypsum constitutes tabular bodies or fill channels. Channels are found associated to the outer facies (Fig.2, F). Tabular deposits interestratified with sabkha and salt pan deposits.

Cherts: Location and characteristics

The chert appears as nodules (2-30 cm in length) lenses (0.3-5 m in length) or uneven beds (several meter in length).

In some sections very rich in chert it is possible to find up to eight episodes through the log. The 70% of these cherts presents a "tubular structure" (Fig. 3). In this case chert is composed of a great many vertical and subvertical tubules. The length of these tubules varies from a few centimeters to 40 cm, and the diameter ranges from 0.5 to 1 cm.

They appear in bioturbated lenticular microcrystalline gypsum facies. They are formed by replacement of the gypsum (BUSTILLO & DIAZ-MOLINA, 1980) and the morphology of the bioturbation structures emerges more clearly in the chert than in the gypsum host rock. These tubules had been interpreted as burrows (DIAZ-MOLINA et al, 1989). When the host rock is incompletely replaced the burrows are the only silicified portion (Fig.3).

The quartz textures of the chert are those typical of evaporite replacements (MILLIKEN, 1979; ARBEY, 1980). The most frequent are: (1) Mosaic of megaquartz (crystal length more than 20µm) (Fig. 3). Crystals enclose prints of euhedral quartz growth, showing alternative dark and clear growth zones. Some crystals are megaquartz zoned by organic inclusions. (2) Aggregates (rosettes) are composed of radiating wedge-shaped megaquartz crystals (Fig. 3). Sometimes these rosettes are zoned.

Fibrous quartz (lutecite and quartzine) and mosaic of microcrystalline quartz (crystals less than 20µm long) appear occasionally. Lenticular pseudomorphs of gypsum crystals are also present. The size of quartz crystals in the pedotubules are generally smaller than in the matrix.

Either some rosette centers and megaquartz crystals show minute organic siliceous corpuscles and occasionally some spores. These corpuscles are thought to have been formed during the first stages of the silicification, when dissolved organic matter is present in the host rock (BUSTILLO and DIAZ-MOLINA, 1980).

The domination of megaquartz (mosaics or rosettes) indicates that pore fluids originating silicification were relatively poor in silica, and the replacement was slow (MILLOT, 1960; BUSTILLO, 1976; ARBEY, 1980; among others). The dissolved or ganic matter could have facilitated the formation of these textures.

Source of silica, location and time of silicification

There is not evidence of biogenic source for the silica. Silica precipitation may be related with the silica enrichments of the ground water in the fans. The detrital sediments of the fans show corrosion of the siliciclastic grains by gypsum (DIAZ-

MOLINA et al., 1989). The leaching of siliciclastic grains during the gypsum cementation-replacement processes may be responsible for enrichment of groundwater.

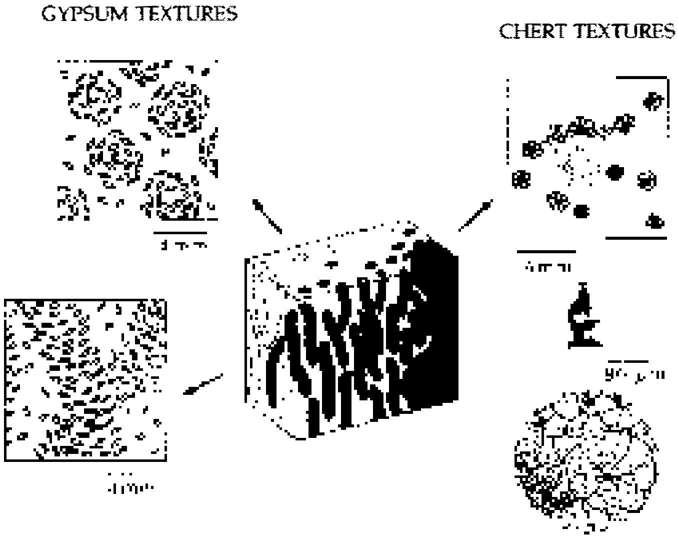

Figure 3

This chert is always associated to gypsum in a sabkha environment. These sabkhas were submitted to alternating floods and dry periods. During dry periods the evaporation increased the silica concentration in the pore fluids, and quartz-satured solutions remained impregnating the bioturbated gypsum. According with ZIJLSTRA (1990) the burrow may be a preferential place of silicification because the oxygen rich water are in contact with the reducing environment of the burrow. Bacteria can also influence silicification (microbia induce silica precipitation as reported BIRNBAUN and WIREMAN, 1984). The porosity and the changes of pH improved the silicification process.

Acknowledgements

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