The Cerros de la Sal, in the west-central part of Antofagasta Province, Chile, form a narrow ridge approximately 45 miles long trending N. 20° E. along the western border of the Salar de Atacama (fig. 147.1). The area is extremely arid and the village of San Pedro has an average annual rainfall of less than 2 inches, although it is at an elevation of over 8,000 feet.

The area was mapped in August 1961 as a part of a ground-water investigation in the Salar de Atacama. The author was assisted part of the time by Ernesto Pérez, geologist of the Instituto de Investigaciones Geológicas. Prof. S. E. Hollingworth and Roy Rutland, of the University of London, spent several days in the area and made many helpful suggestions concerning the structure of the area. No detailed geologic mapping had previously been done in this area. Various authors had mentioned the structure of the Cerros de la Sal, however, and had called them either salt domes or salt anticlines; Brüggen (1950) called them both.

The oldest rocks exposed in the northern part of the basin containing the Salar de Atacama are continental deposits of the Salinas de Purilactis Formation of Jurassic (?) age (Brüggen, 1950). The formation is composed of approximately 1,800 feet of fine-grained well-stratified basin-type deposits with a few intercalated beds of evaporites including salt, gypsum, and anhydrite.

The Salinas de Purilactis Formation is overlain by approximately 15,000 feet of continental sediments of the Purilactis Formation of Cretaceous age (Brüggen, 1950). The Purilactis Formation is subdivided into three members, as yet unnamed, that are herein referred to as the lower, middle, and upper members. The upper and lower members of the Purilactis Formation are relatively coarse-grained clastic sediments.

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**Figure 147.1.—Index map of Chile showing location of Salar de Atacama.**

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**Explanation**

- **Eolian sand**
- **Piedmont deposits**
- **Tuff**
- **San Pedro Formation**
- **Dome**
- **Fault**

Explanation for figure 147.2.
FIGURE 147.2.—Aerial photograph showing the geology of the Cerros de la Sal.
The middle member is composed of fine-grained red-bed sediments and evaporite deposits typical of deposition in continental basins under arid conditions.

The San Pedro Formation of early Tertiary age (Brüggen, 1950) is of continental origin and is composed of more than 6,000 feet of sediments and evaporite deposits. In the Cerros de la Sal it was possible to distinguish two types of deposit in the formation consisting predominantly of fine-grained clastic sediments and of salt beds (fig. 147.2). The few conglomerate beds in the sedimentary sequence contain well-rounded phenoclasts, many of which were derived from the conglomerates of the upper member of the Purilactis Formation. The salt beds of the San Pedro Formation are apparently the result of redeposition and further concentration of the evaporite salts from the Jurassic (?) and Cretaceous formations.

The San Pedro Formation is overlain by rhyolitic tuffs of late Tertiary age, which are in turn overlain by Quaternary piedmont deposits.

The Cerros de la Sal are formed by a series of domes and doubly plunging synclines and anticlines. They are bounded on the east by a well-exposed border fault of unknown displacement, and there is evidence of a fault along the western border. The attitude of beds of well-stratified clastic sediments ranges from very steeply dipping to slightly overturned on the flanks of the major structures. In many localities the tops of the clastic beds can be determined by primary sedimentary features. In places the salt beds appear to be structureless on the surface, due to the masking effect of a mantle of salt up to 1 meter thick, which has resulted from leaching and subsequent redeposition on the surface following the infrequent rains. Primary structure in the salt beds may be observed in fresh exposures. The stratification of the salt beds is easily seen on aerial photographs (fig. 147.2).

Faulting within the domes consists of minor vertical to high-angle normal faults. The boundary faults are nearly vertical with the downthrown blocks on the side away from the Cerros de la Sal. North of the area covered by figure 147.2 the upper Tertiary strata on the flanks of the Cerros are displaced by low-angle (14°) thrust faults trending north to N. 30° E.

Folding and doming of the San Pedro Formation began before the deposition of the upper Tertiary tuffs, and continued to the present. The tuffs were deposited as a blanket over the pre-existing topography. In some localities they are flatlying and rest with sharp unconformity on the San Pedro Formation. In other localities they are conformable with the San Pedro clastic sediments and have been tilted up to 90°, thus indicating continued development of the structures after the deposition of the tuffs.

The author considers that (1) the preservation of bedding within the salt, (2) the parallelism of bedding between the clastic beds and the salt, and (3) the complete lack of inclusions or fragments of older rock within the salt beds are strong arguments against deep-seated diapirc folding being an important force in the formation of these structures. On the other hand, complex structures in Tertiary beds cannot be the product of regional tectonics in an area where the underlying Cretaceous strata are gently folded. Probably the Atacama basin subsided under the lower Tertiary sedimentary load, resulting in a slight tilting of the unconsolidated Tertiary sediments toward the center of the basin (fig. 147.3). Gravitational gliding toward the center of the basin, along beds of salt or gypsum in the San Pedro Formation, produced horizontal compression resulting in the upfolding of the Cerros de la Sal. This process of subsidence, gliding, and folding probably continued throughout the rest of the Tertiary and Quaternary and may still be active.

There is no evidence in either the salt domes or in the regional geology to indicate marine deposition of the sediments related to these structures. The Cerros de la Sal may be unique in that they demonstrate well-exposed salt domes and anticlines in Tertiary continental sediments.

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