

David Colchester introduced the main speaker for the evening, Dioni Cendón, who spent some years after his graduation in Spain studying evaporite deposits in Europe principally on problems associated with stratigraphy and paleo-climatology eventually submitting a PhD to the University of Barcelona some years ago.

‘Evaporites’

Dioni Cendón commenced his lecture by noting that evaporite minerals are usually poorly represented in collections due to the tendency for them to absorb or lose water constantly they tended to be fragile and to break up. This did not detract from the significance of such minerals to commercial operations and the information to be derived on climatic conditions in the near or distant past by studying deposits. The speaker advised that during his lecture he would be looking at aspects of the genesis of evaporites, at modern marine environments, some continental environments, at the fossil record and would then be showing a series of views of various evaporite minerals.

The speaker spent some time dealing with the processes of evaporite formation in different situations and environments and referring to the features of varying solubilities and evaporation rates before moving on to mention some of the commercial aspects of evaporite availability. The most important evaporite has always been common salt, sodium chloride, which has held considerable commercial significance if not strategic importance and been a vital commodity throughout human history. Other evaporites however have also had considerable significance to human requirements and been long recognised. Chinese workers up to 4,000 years ago were describing some fourteen different evaporite minerals and were even describing processes to precipitate evaporites from sources. Today there are over 14,000 processes recorded that use salt. Approximately 70% of sodium chloride production goes into or is used by the chemical industry, particularly for glass-making, paper and detergents but also numerous other uses. Other commercially significant evaporites are nitrates, potash, gypsum, boron and barium-containing salts.

The speaker next spent some time describing various features of evaporite production utilizing evaporation ponds noting that producers needed about sixty-five tons of sea-water to produce one ton of sodium chloride and about eighteen months for the process. Views of evaporation ponds noted the various colours established in waters of differing brine concentration due to the proliferation of algae such as *Dunaliella Salina* which imparts a red colour.

Total world production of halide is about two hundred million tons per year with usually most of that being for use internally and only about 28-30 million tons per year being traded outside the country of production. Australia is the world's largest single exporter of salt with about 28% of the trade, most of which, about 80%, is produced in W.A. with South Australia making about 14% and the other states the remainder. Halide exports earn about \$22 per ton or about \$200 million in 1999, compared to 1965 when exports were virtually non-existent. Australian salt goes mostly to Japan although there has been a limitation imposed by Japanese importers who can only accept up to 50% of their halite requirements from any one country, Mexico supplying the rest of Japanese needs. In the last few years Korea has emerged also as a substantial market for Australian salt.

Dioni Cendón referred to Lake Macleod, a coastal lake near to Carnarvon in W.A. The lake is a natural evaporation basin of approx 2,000 square kilometers in surface area, on

the coast but cut off from direct contact with sea-water by dunes and outcrops. The water in the lake normally carries about ten times more salts than sea-water and producers have had to merely run lake water into crystallizing ponds to obtain halite and gypsum, the gypsum appearing in the lake from land drainage and the process taking much less time than the eighteen months needed to recover halite from sea-water. The speaker then moved on to show views of other natural evaporation basins elsewhere in the world also of significance to evaporite producers such as the Salar de Atacama which is about 100 kilometers long and 40 kilometers wide on the Chilean altiplano at 2,400 meters altitude. (Salar means salt lake). The climate in that area is extremely arid and with the lake water normally carrying a high concentration of solutes producers also have to merely run water into crystallizing ponds deriving a variety of salts in order of their respective solubilities, sylvite, carnallite, glauberite, polyhalite, lithium and magnesium salts as well as halite. There were a number of other salares in the central South American altiplano such as the Salar del Rincón near Puna at about 4,000 meters and which is fed by a geothermal spring. Depending on the source and constituents of the water inflow South American salares may be more commercially significant for their nitrate, lithium or boron content.

The speaker moved on to consider the fossil record of evaporite deposits mentioning particularly the finding of substantial amounts of sylvite, (KCl) in certain locations when this salt does not readily precipitate in quantity from modern evaporating seawater. The suggestion therefore was that the composition of the ocean may have been different in the past and has changed from period to period over the last 400 million years. Examination of evaporite deposits and analysis of the various constituents has also indicated that evaporites in a deposit may have been derived from sea-water for a period and then from land drainage. Commercial exploitation of fossil evaporite deposits on land particularly in America and Europe is at least as economically significant as extracting minerals from evaporating sea-water or from natural inland evaporation basins.

Dioni Cendón finally worked through a large number of slides presented through the Power Point screening system of views of different evaporite minerals and was able to refer to examples in public collections such as that of Howard Worner currently on view in the University of Wollongong. In general however he advised that for the collector evaporite minerals were certainly likely to present a problem of stability with changing ambient levels of humidity and could only advise that a specimen suspected or expected to be susceptible to humidity changes be kept sealed in a transparent container.