Lead-Zinc Ores Dependent on Cyclic Sedimentation
(Wetterstein-Limestone of Bleiberg-Kreuth, Carinthia, Austria)

T. Bechstädt
Munich, F.R.G.

Lagoonal sediments of the upper part of the Wetterstein-limestone (Ladinian/ Cretaceous, Alpine Triassic) of the lead-zinc deposit of Bleiberg-Kreuth were examined. They are influenced by cyclic successions, which show emersion periods. These emersions can also be found in similar rocks of the same age. The cyclothems are attributed to eustatic fluctuations. In the rocks, underlying the unconformity, karstic cavities were formed. The lead-zinc ores are thought to be mainly intra-karstic sediments, detrital and chemical deposits. The metal-concentration in the cavities seems to have originated from a directly preceding enrichment in the evaporitic phase, as well as from the erosion of this and other neighboured sediments.

Introduction

The upper Wetterstein-limestone of the Northern Limestone Alps and the Drau-range contains several lead-zinc deposits, which are partly economically important; most of these have been known for a long time. In Austria, at the moment only the deposit of Bleiberg-Kreuth is under production (fig. 1). The lithostratigraphy of this area was investigated by Holler (1936, 1953, 1960). He declared, that the uppermost 60 m of the Wetterstein-limestone are characterized by "intercalations" in the normal Wetterstein-limestone. They consist of milky-white dolomites, green to greenish-grey "marls" and black breccias. Schneider (1954) called a comparable development in the Wetterstein-limestone of the Northern Calcareous Alps "special facies" with reference to the "Zwischenschichten" of Sander (1936). Because s.s-parallel ore layers occur in connection with these intercalations, they are called "Edle Flächen" (precious layers). They are said to consist of a lower, 10–20 cm thick black breccia, a middle, 1–2 m thick "Zwischenstein" (rock-in-between) and an upper, 10–20 cm thick milky-white dolomite layer (Holler 1936). In Bleiberg this sequence is said to appear five times in a profile of 60 m, whereas two "Edle Flächen" are said to be a little different. Holler deduces from this appearance a regular rhythmic sedimentation, which he tries to connect with an Upper-Ladinic volcanism. Although I agree to the presence of rhythms respectively cycles (Bechstädt 1973 and in press), it should be mentioned that they are normally more complicated.

At the time of sedimentation of the Wetterstein-limestone other facies existed in the neighborhood. In the Northern Calcareous Alps the reef-facies of the Wetterstein-limestone grew towards the top into the basin-facies of the Reifling limestone resp. the Partnach beds (Schneider 1964; Sarnthein 1965; Ott 1967; Bechstädt and Mostler, in press). Consequently the lagoonal environment expanded. In the Drau-range the facies becomes generally shallower at the time of the upper Wetterstein-limestone. In the lagoonal facies of Bleiberg the fossil content is nearly the same as in the Wetterstein-limestone of the Northern Limestone Alps (different types of algae, Megalodonts etc.). The dasyclad algae Poikilospora duplicata and Clypeina besici indicate the stratigraphic position of the sequence. They can be found from the Cordevolic to the Tuvalic substage (Ott 1972). The Wetterstein-limestone, which contains these algae, is normally placed into the Cordevolic stage and belongs therefore to the Lower Carnian. From different
Facies Types and Environment

Marine shallow water deposits can be subdivided, according to their water depth, into a subtidal- (permanently covered by water), an intertidal- (between medium low tide- and medium high tide level) and a supratidal region (above medium high tide level, only sometimes inundated by heavy seas or reached by sea spray). In the profiles investigated, we can find all of these zones, arranged in a cyclic sequence (BECHSTÄDT 1973 and in press).

Subtidal: often mud-supported arenitic-lutitic limestones with Megalodonts, dasyclad algae etc. The frequent occurrence of the dasyclad algae indicates their living conditions were good, water depths from 1 to 10 m (JOHNSON 1961). On the other hand the abundance of individuals (Megalodonts and Dasyclads), connected with the poverty of species shows the strong limitation of living conditions, probably caused by an increased salt content. *Potikiloporella duplicata*, which occurs very frequently, can be found in the Northern Limestone Alps only in a lagoonal environment apart from reefs (OTT 1967).

Intertidal: arenitic-ruditic limestones, frequently with small laminated fenestrae (TEBBUTT et al. 1965). Stromatolitic mats are common. Small layers often are reworked or pinched out, layers of “green marls” may be intercalated. It is evident that these sediments are to be related with times of turbulent sedimentation. On the other hand there are no signs of longer drying periods, so that we can place these sediments into the intertidal environment.

Inter- to Supratidal (fig. 2): lutitic-arenitic carbonates, mostly dolomites, with frequent and often large fenestral fabrics. The fenestrae are distinctly larger than grain supported interstices. They are a sign of inter- to supratidal conditions during sedimentation (SHINN 1968). Prism- and sheet cracks can be observed also. They may lead to a total cut-off from the underlying sediment (GERMANN 1969), so that an early lithification is to be considered. Also teepee-structures can be found sometimes, which are attributed to expansion caused by warming of a lithified sediment. Stromatolites