

Hydrotalcite and quintinite from Dypingdal, Snarum, Buskerud, Norway

Gunnar Raade

Introduction

The new mineral species hydrotalcite was described by Hochstetter (1842) from Snarum. There is no doubt that the type locality must be the Dypingdal serpentine-magnesite deposit. A sample of the mineral had been presented by Prof. Scheerer to Dr Marchand, who gave it to Hochstetter for investigation. The chemical analysis performed by Hochstetter shows that the mineral is essentially a hydrated carbonate of magnesium and aluminium. It was associated with "steatite" which is usually regarded as a synonym of talc, $\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$. However, the chemical analysis of Hochstetter (1842) shows an appreciable amount of Al_2O_3 (12.52 wt%).

Hochstetter's analysis of hydrotalcite gives an $\text{Mg}:(\text{Al}+\text{Fe}^{3+})$ ratio of 2.80:1.00. Its Fe_2O_3 content of 6.90 wt% is suspiciously high and might indicate contamination by an iron-rich mineral. An extensive older literature exists on hydrotalcite, discussing whether it should be regarded as a distinct mineral or a mixture, and is summarized by Frondel (1941). The validity of hydrotalcite as a species was shown by Manasse (1915), who obtained the chemical formula $\text{Mg}_6\text{Al}_2\text{CO}_3(\text{OH})_{16}\cdot 4\text{H}_2\text{O}$, with $\text{Mg}:\text{Al} = 3:1$. The trigonal crystal structure of hydrotalcite was first determined by Allmann & Jepsen (1969).

Fron del (1941) described manasseite as a hexagonal polytype of hydrotalcite from Snarum and from Amity, New York. Hydrotalcite and manasseite are frequently intergrown in the Dypingdal deposit and are almost indistinguishable in appearance (Neumann 1985). The nomenclature of the hydrotalcite supergroup has recently been reviewed by Mills et al. (2012). According to IMA rules, polytypes are not to be regarded as distinct species. Therefore, the name manasseite is discredited. The original hydrotalcite is hydrotalcite-3R, and manasseite becomes hydrotalcite-2H.

Hydrotalcite belongs to a large group of naturally occurring and synthetic *layered double hydroxide* (LDH) compounds (Mills et al. 2012). Their structures are derived from that of brucite, $\text{Mg}(\text{OH})_2$, in which edge-sharing $\text{Mg}(\text{OH})_6$ octahedra form continuous sheets parallel to (001), linked by relatively weak hydrogen bonds. In the LDH compounds, the brucite-like layers contain both divalent and trivalent cations, creating a surplus positive charge that is balanced by interlayer anions, coupled with additional water molecules. In the case of hydrotalcite, carbonate (CO_3^{2-}) is the interlayer anion. According to Mills et al. (2012), the formula $\text{Mg}_6\text{Al}_2(\text{OH})_{16}[\text{CO}_3]\cdot 4\text{H}_2\text{O}$ is recommended for hydrotalcite, with the interlayer anion shown in square brackets. The first part of the formula, $\text{Mg}_6\text{Al}_2(\text{OH})_{16}$, indicates the composition of the brucite-like layer. The water molecules and interlayer anions are intercalated between two brucite-like layers, hence the designation 'layered double hydroxide'.

On the track of quintinite

In 1986, I published the results of reconnaissance electron microprobe analyses of four hydrotalcite samples from Dypingdal (Raade 1986). The mean analytical results of $\text{Mg}:(\text{Al}+\text{Fe})$ ratios were, with numbers of individual analyses in parentheses: 2.80:1 (1),