Howlit Minerali Üzerinde Çalışmalar

Studies On Howlite Mineral

Hüseyin GÜLENSOY [1] and Ali DEMİRCİOĞLU [2]

Bu çalışmalarda, Sındırgı yakınlarında tezahür eden Howlit mineralinin kimyasal bileşimi ortaya konmuş ve ayrıca dehidratasyonu da incelenmiştir. Dehidratasyon çalışmaları DTA ve x - ışınları analizleri ile de takib edilmiştir. Elde edilen kalsine ürünler, mikroskopik incelemelerle de detaylı bir şekilde etüd edilmiştir.

In this paper chemical composition, differential thermal analyses and dehydration of nodular howlite mineral occuring around Sındırgı area are summarized. In addition, x - ray diffraction and microscopic studies are made on the above mentioned mineral.

Investigations revealed that howlite mineral converts into calcium borate through an exothermic reaction at 850 - 900°C following completion of dehydration. Another point of interest observed during the processes is that, boron - hydrates which are stable intermediate products are not formed during dehydration, contrary to the other boron minerals. This fact became clear especially in x - ray studies.

INTRODUCTION AND HISTORY

Howlite is a boron mineral appearing in $Ca_2SiB_5O_9(OH)_5$ or $4CaO \cdot 2SiO_2 \cdot 5B_2O_3 \cdot 5H_2O$ composition in monoclinal system and found generally in nodular masses. It is a boron mineral with an inner structure of unvanished porcelain appearance, without showing any structural property, or sometimes it is found in chalk or soil. It is mostly mistaken as pandermite and bakerite minerals. It is white coloured. It has a hardness of 3.5 and a specific weight of 2.53 - 2.59.

(1) Istanbul University, Faculty of Chemistry.
(2) Min. Res. and Explo. Inst. Ankara.

Theoretical composition of the mineral is : 28.66 % CaO
15.34 % SiO_2
44.49 % B_2O_3
11.51 % H_2O

Since it does not occur in large deposits it has no commercial value. Therefore, investigations on this mineral are rare and rather centered on its crystal structure (1), (2). In addition, an investigation on the calcination of howlite and dissolution of calcinated products can be mentioned (3).

In this paper, howlite occurrences found at 3 km. south - east of Demyan Sağır village, 23 km. south of Sındırgı are described. Here, the howlite minerals are laying down in horizontal levels in a regular order between the limestone masses. Investigations are directed to the analytical composition, differential thermal analyses, mineralogical studies and to the calcination products of the mentioned minerals.

TESTS AND DISCUSSIONS

I. ANALYTICAL STUDIES

The above mentioned howlite mineral is found to be composed of

28.62 % CaO
15.59 % SiO_2
43.10 % B_2O_3
11.63 % H_2O

through conventional analysis methods. In addition, it contains 0.26 % alkaline oxides and 0.38 % MgO. So, it is not a % 100 pure mineral. In fact, an occurrence of howlite with theoritically determined composition can not be found because of the situtation of the mineral. However, the mineral found at Sındırgı is not much differing from those taking place in the literature (4).

II. DIFFERENTIAL THERMAL ANALYSES

DTA curve resulting from the differential thermal analyses of Sındırgı howlite mineral is given in Fig. 2 at page 26.

As will be seen in the figure DTA curve contains an endothermic peak at 600°C, an exothermic peak at 930°C and a second endothermic peak around 1000°C. It is clear that the first endothermic peak corresponds the dehydration. Exothermic peak indicates a new crystallization after dehydration, and the last endothermic peak the fusion. This will later be confirmed also by x - ray diffraction curves.

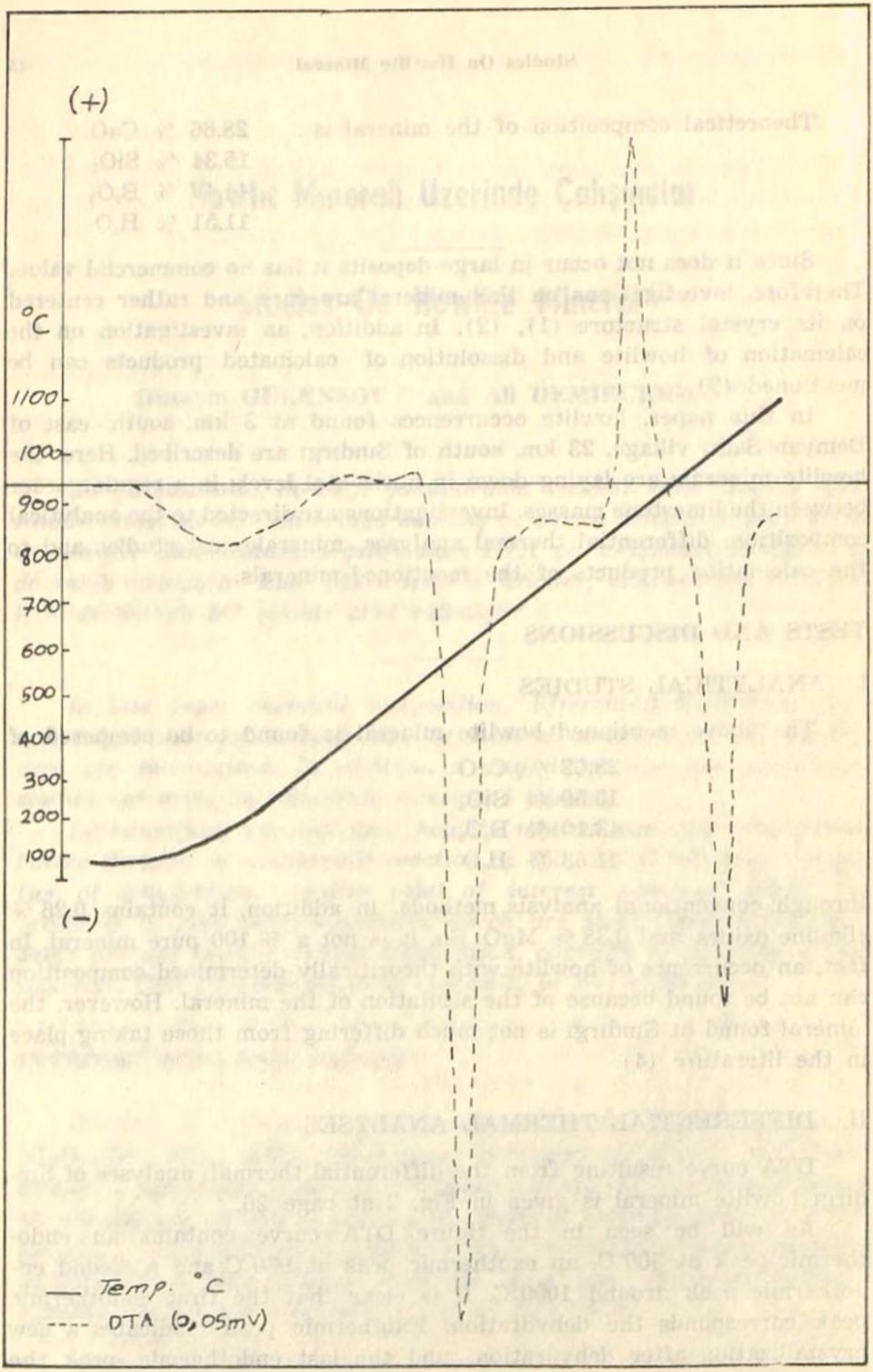

Fig. 1 DTA curve of howlite.

In literature, DTA curves of howlite minerals contain only one endothermic peak (at 530 - 545°C) and they do not continue above 600°C. (5).

III. DEHYDRATION

Water loss of howlite mineral because of temperature is determined by static method. In this method, the samples were heated at given temperatures for 16 hours. Dehydration curve is given below in Fig. 2. at page 28. Accordingly, howlite loses 1 mol of water (in much difficulty) only when heated upto 450°C. The loss of following 3 molecules can only be obtained by heating 100°C more (450 - 550°C). The last molecule removes when temperature rised to 650°C.

Stable intermediate products of borate hydrate observed during the calcination of many boron minerals such as colemanite (6, 7), ulexite (8) and tunellite (9) are not formed during the calcination of howlite. This may be a result of SiO_2 content of howlite mineral. Because the other boron minerals mentioned above do not contain SiO_2.

In addition, the colour of samples calcined in 300 - 500°C changes definitely into grey. However, later, when temperature is rised they regain their original colour of white.

The results obtained from these dehydration studies are differing from those recorded in the literature (3). This may be because of the technique used or the different characteristics of the samples.

IV — *X* - RAY DIFFRACTION AND STUDIES UNDER MICROSCOPE

As well known, *x* - ray analyses on a mineral are integrated by microscopic studies. An evaluation based on such a study gives more reliable results. Calcinated products of howlite mineral obtained in a series of temperatures are studied under microscope and, parallel to it, *x* - ray analyses are made. The results obtained are given below.

1. *X* - Ray Diffraction Curves :

Below are the curves of howlite mineral belonging both to the original form and to calcinated products obtained at 150°C, 250°C, 350°C, 450°C, 550°C, 650°C, 750°C, and 850°C temperatures. The curves upto 450°C are similar while those beginning from 500°C show a definite amorphous formation because of a whole water - loss of the mineral.

X - ray diffraction curves are given in Fig. 3 all together (Page: 29)

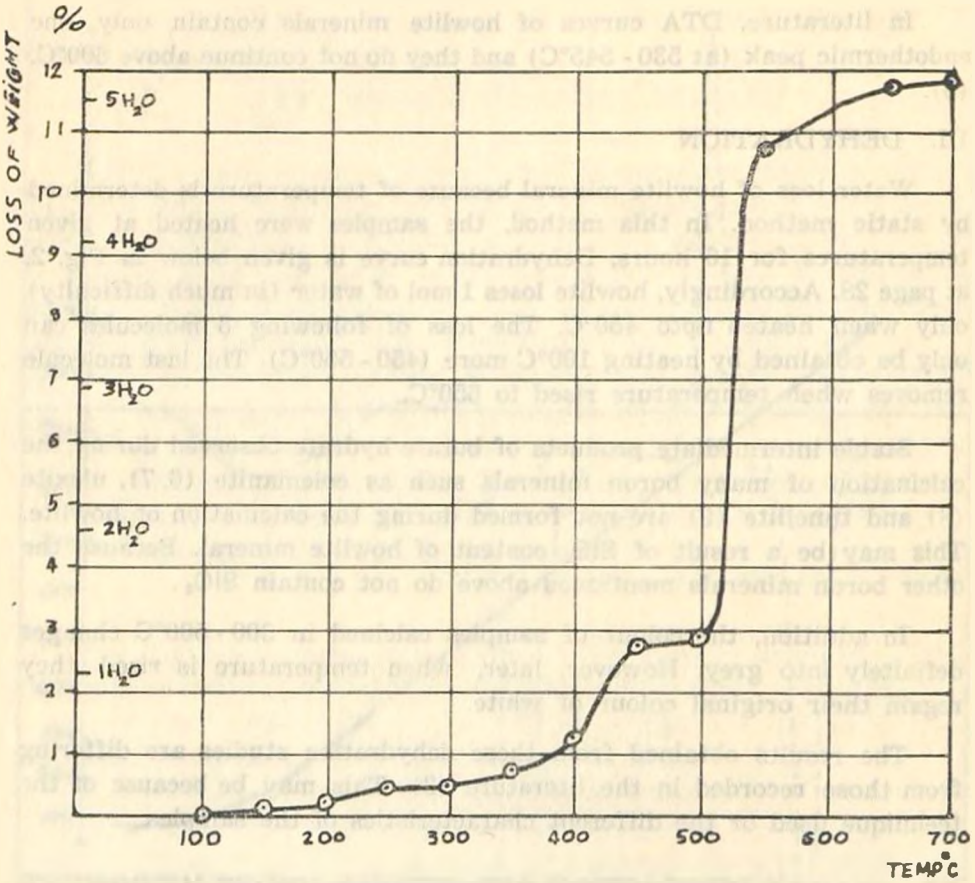

Fig. 2: Dehydration curve of Howite mineral.

Characteristic peaks of howlite mineral become poorer from 300°C upward. Deformation of the mineral because of water loss is completed at 550°C. Calcium borate formation begins at 750°C and continues at 850°C too.

2. Parallel to x - ray studies micro - photes of both the original sample and the calcinated products obtained at above mentioned temperatures are taken and evaluated. They are shown below. (Photos are taken magnifying 100 times and using cross - nicol, excluding Photo No. 1).

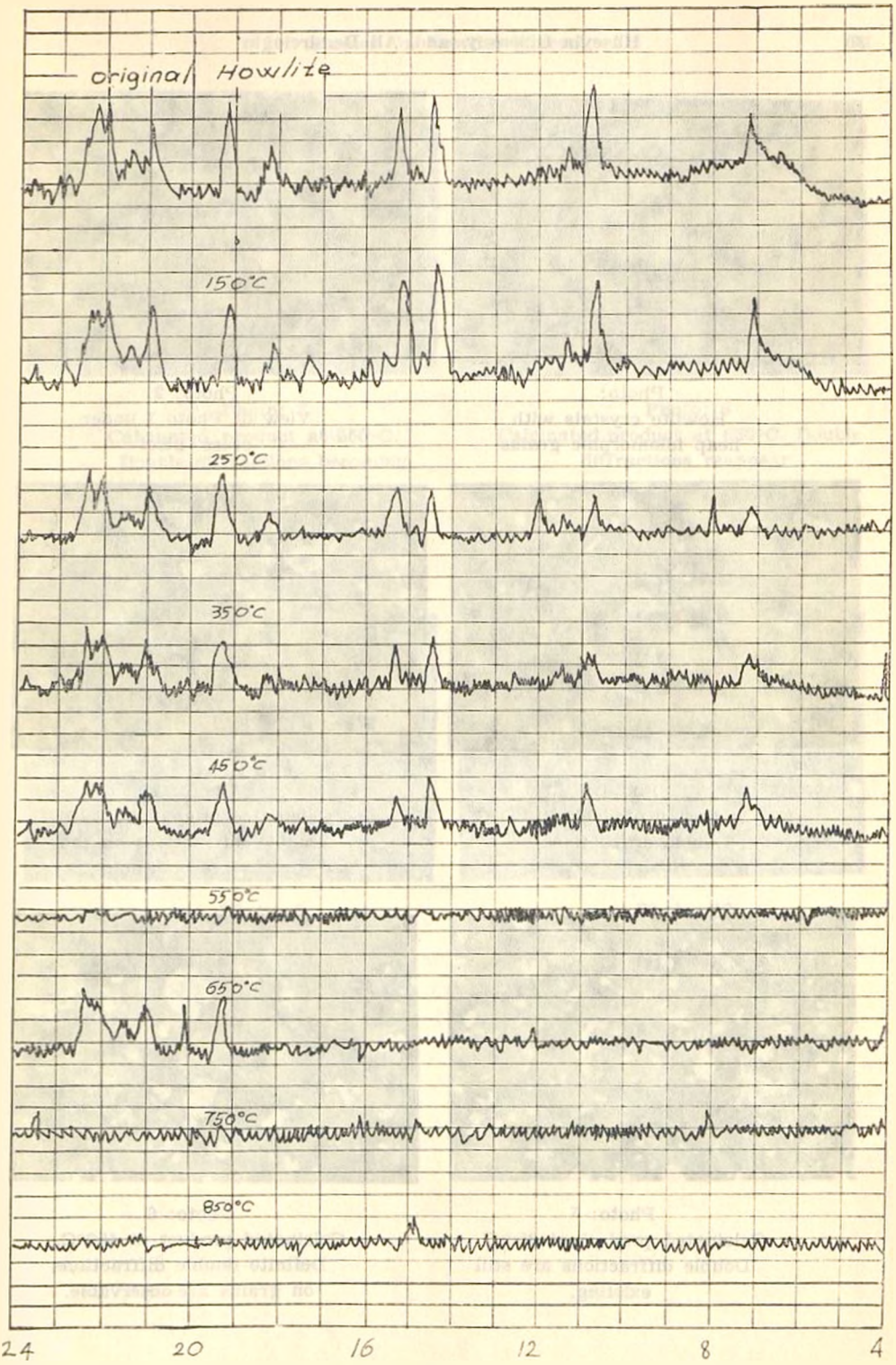

Fig 3: x-ray diffraction curves of howlite mineral and calcinated products

Photo: 1
Howlite crystals with heap idiomorphic grains

Photo: 2
View of Photo 1 under cross - nicol

Photo: 3
Calcinated product at 150°C. Double diffractions are definite.

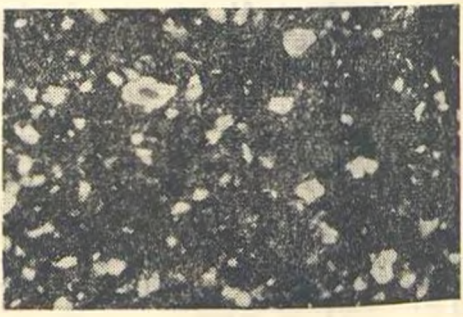

Photo: 4
Calcinated product at 250°C. Double diffractions on the grains are continuing.

Photo: 5
Calcinated product at 350°C Double diffractions are still existing.

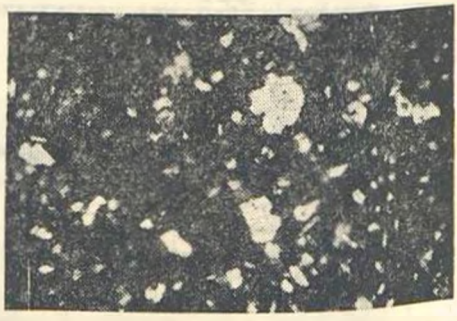

Photo: 6
Calcinated product at 450°C. Definite double diffractions on grains are observable.

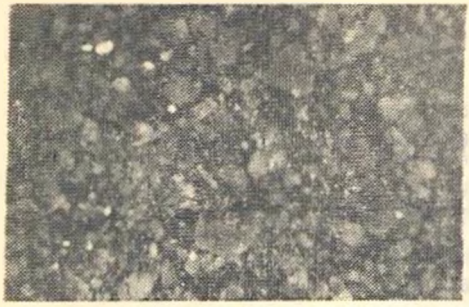

Photo: 7
Calcinated product at 550°C.
Double diffractions becoming poorer.

Photo: 8
Calcinated product at 650°C. Double diffractions reappear.

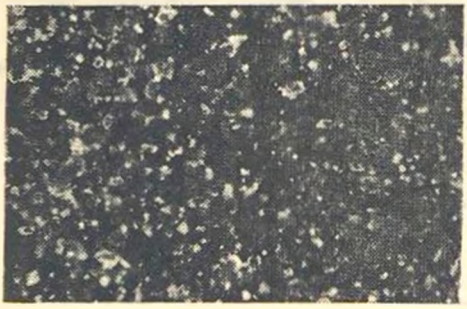

Photo: 9
Calcinated product at 750°C.
Double diffractions exist.

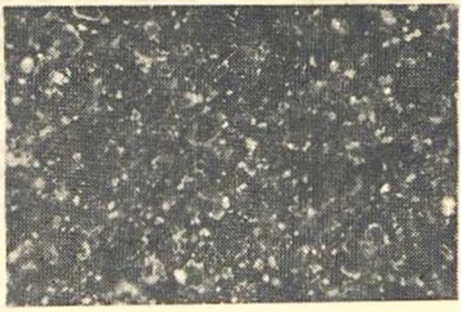

Photo: 10
Calcinated product at 850°C.
Double diffractions exist.

LİTERATURE

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