The thermal decompositions of natural and synthetic andersonites were studied. Two partly overlapping dehydration steps and three partly overlapping decarbonation steps were observed. The second dehydration and the first decarbonation steps also partly overlap. During decarbonation, the gradual formation of sodium diuranate and monoclinic and hexagonal phases in the Na$_2$U$_2$O$_7$-CaUO$_4_x$ system was proved. The results were correlated with measured infrared spectra using site and factor group analysis and X-ray structure analysis. The chemical formula inferred for natural andersonite, Na$_2$Ca[UO$_2$(CO$_3$)$_3$]$_x$·5.6H$_2$O, agrees with that proposed for its synthetic analogue.

Andersonite has been found in several deposits and also synthetized by several authors. Infrared spectra of both natural and synthetic specimens and luminescence spectra of the mineral have been published.

A thermal analysis of synthetic andersonite has been described. According to the crystal structure of synthetic andersonite [1], only five water molecules in the formula were found in the final Fourier map. The possible statistical distribution of the remainder in a structure channel is presumed. On the basis of our preliminary conclusions [2, 3], the formula Na$_2$Ca[UO$_2$(CO$_3$)$_3$] · 5.6H$_2$O was proposed for synthetic andersonite [1].

In this paper, attention is especially paid to the content of molecular water in natural andersonite and for comparison in synthetic andersonite, using combined TG and DTA and IR spectroscopy. A complex contribution to the crystal chemistry of andersonite will be published elsewhere [4]. The paper forms part of the scientific reassessment of secondary uranium minerals from the collections of the National Museum in Prague.
Experimental

Synthetic andersonite was prepared by the method described by Čejka [5]. The specimen of natural andersonite (Jáchymov deposit, Czechoslovakia) was obtained from Dr. Zdeněk Mrázek. Identifications were based on the JCPDS Powder Data File. Chemical analysis of synthetic andersonite was carried out. The DTA curve of synthetic andersonite was recorded with a DTA instrument constructed at the Department of Silicates, Prague Institute of Chemical Technology: sample weight 739.2 mg, heating rate 10 deg·min⁻¹, static air atmosphere, reference material Al₂O₃, vessels made of a Pt–Rh alloy, and Pt–Rh wires as thermocouples. Simultaneously recorded TG–DTG–DTA curves of synthetic andersonite, obtained with a MOM derivatograph (sample weight 253.8 mg, heating rate 10 deg·min⁻¹, and gaseous CO₂ quantitatively determined [6]) were taken into account. TG curves of both natural and synthetic specimens were studied by using a Stanton Redcroft TG 750 Thermobalance (dynamic air atmosphere, 10 ml·min⁻¹, heating rate 10 deg·min⁻¹, sample weight 1.923 and 1.87 mg, respectively). The IR spectra were measured with Perkin–Elmer spectrophotometers (Model 225: Nujol; and Model 325: KBr disk).

Results and discussion

Thermal analysis

Dehydration

Andersonite undergoes dehydration in two steps (Figs 1–3). The dehydration process is manifested by an endotherm at 190–200°C. Four water molecules are liberated within the interval 50–155°C (natural) or 50–200°C (synthetic). The

![Fig. 1 DTA curve of synthetic andersonite (sample mass 739.2 mg)](image-url)