Correlation between the Radiation Induced Colours and the OH-stretching Vibrations of Amazonite

A. Banerjee

Institut für Geowissenschaften, Edelsteinforschung, Johannes-Gutenberg-Universität, Mainz

Z. Naturforsch. **48a**, 1041–1042 (1993); received July 16, 1993

The changes of colour and the OH-stretching vibrations of amazonites (K-Feldspar) on irradiation have been investigated. It is concluded that the changes are caused by radiation induced crystal defects.

The colours of many feldspars are enhanced by natural radiation. The same phenomenon can be simulated by X-ray radiation in the laboratory. The changes of colour and the formation of defect centers in different feldspars including one microcline (amazonite) after X-ray irradiation has been investigated using e.p.r. spectroscopy [1].

The main colours of amazonite are green, bluish green and blue.

According to [2] they are caused by Pb^{3+}, which is produced by the reaction of radiation induced Pb^{2+} with radiation induced dissociation products of structurally bound water. The present note deals with the changes of the OH-stretching vibrations and the colours of amazonite caused by X-ray radiation.

Six samples of green, greenish blue and blue amazonite were X-ray irradiated (Mo-target/80 kV and 30 mA). The thickness of the samples was about 0.05 mm. All of them became darker after irradiation. The IR-transmission spectra of the samples were measured using an FTIR-spectrophotometer (Perkin-Elmer, Model 1760).

All of the samples contained structural water, as was revealed by their IR-transmission spectra. The green and greenish blue amazonites show two distinct absorption bands at 3698 and 3622 cm^{-1} due to OH-stretching vibrations, and one absorption band at 3420 cm^{-1}, which indicates the presence of H-bonded OH. The IR-transmission spectra of the blue amazonites, on the other hand, are characterized by the absence of the absorption bands at 3698 and 3622 cm^{-1}, and by the presence of the absorption band at 3420 cm^{-1}, indicating that they contain only H-bonded OH.

As shown in Fig. 1 (a to f), the intensities of the absorption bands related to the OH-stretching vibrations mentioned above decreased considerably on X-ray irradiation of the amazonite samples due to the formation of crystal defects. Such crystal defects are

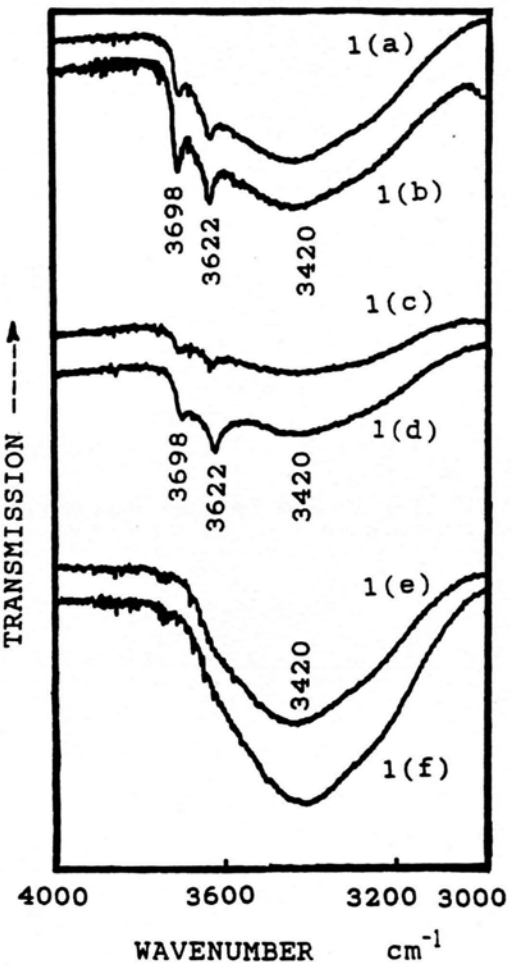

Fig. 1. IR-transmission spectra of amazonites showing changes of the OH-stretching vibrations of amazonites before and after irradiation: (a) Green amazonite after and (b) before irradiation; (c) Blue-green amazonite after and (d) before irradiation; (e) Blue amazonite after and (f) before irradiation.

Reprint requests to Dr. A. Banerjee, Institut für Geowissenschaften, Edelsteinforschung, Universität Mainz, 55099 Mainz.

0932-0784 / 93 / 1000-1041 $ 01.30/0. – Please order a reprint rather than making your own copy.

formed also in some other minerals, e.g. topaz, on irradiation. It has been proved [3, 4] that in case of topaz the OH-stretching vibrations change on irradiation, which, according to [5], is related to the crystal defects produced by irradiation. The Fe^{2+} ions present in topaz are ionized to Fe^{3+} ions on irradiation, and the free electrons are localized on the $(OH)^-$ vacancies, forming defect centers. The changes of the OH-stretching vibrations of the samples under investigation indicate that they are caused by similar crystal defects in amazonite as Pb^{2+} is ionized to Pb^{3+} as proposed in [2].

[1] B. Speit and G. Lehmann, Phys. Chem. Minerals **8,** 77 (1982).
[2] A. M. Hofmeister and G. R. Rossman, Amer. Miner. **70,** 794 (1985).
[3] R. D. Aines and G. R. Rossman, Amer. Miner. **71,** 1186 (1986).
[4] A. Banerjee, Z. Naturforsch. **47a,** 923 (1992).
[5] A. N. Platonov and P. Belichenko, Morfol. Svoisstav Genesis Mineralov AN Ukr, SSSR **1,** 69 (1965).

Erratum

Kenneth E. Edgecombe, Vedene H. Smith, Jr., and Florian Müller-Plathe, Nonnuclear Maxima in the Charge Density, Z. Naturforsch. **48a,** 127–133 (1993).

On page 132, the sentence

"This is 0.08×10^{-5} E_h lower than that obtained by Freeman and Karplus [23] ..."

should read

"This is 8×10^{-5} E_h lower than that obtained by Freeman and Karplus ...".

Verantwortlich für den Inhalt: A. KLEMM
Satz und Druck: Konrad Triltsch, Würzburg