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L. G. Gilinskaya^a

^a Institute Geology and Geophysics, Novosibirsk, USSR

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STRUCTURAL AND CHEMICAL PECULIARITIES OF NATURAL APATITES AS REVEALED BY EPR SPECTRA

L.G.GILINSKAYA

Institute Geology and Geophysics, Novosibirsk 630090,
 USSR

Apatite- $\text{Ca}_5(\text{PO}_4)_3(\text{F}, \text{Cl}, \text{OH})$ is a polygenic mineral widely-spread in nature. A number of important properties of this complex matrix was found by EPR studies. It was shown, that the paramagnetic centres can be used as original probe of crystallostructural and chemical peculiarities which are formed at a) isomorfous substitution, b) deflection of composition from stoichiometry. In natural apatites isomorfous admixtures of Mn^{2+} , Cu^{2+} , Fe^{3+} , V^{4+} ions in CaI, CaII position are registered. The distribution regularities of the admixtures between two Ca-positions are considered. If the Ca-cations are substituted isomorphically by actinonide ions, PO_4^{3-} -anions are destructed, namely one of the four oxygen atoms comes off and PO_3^- -group is formed. The capture of electron by PO_3^- -fragment under the effect of ionizing radiation results in the formation of paramagnetic PO_3^{2-} -centre of electron type with peculiar EPR parameters. Depending on the P-OII(I) or P-OIII(III') the PO_4^{3-} -anion bond, which is broken, as well as on the nature of substituting actinonide ion (U or Th) the variety of PO_3^{2-} -centres (four type) with different EPR parameters could be registered. A number of radical ions in the position PO_4^{3-} -anion- CO_3^{3-} , CO_3^- , SO_3^- , SiO_3^- are observed. The spectrum of H^0 is identified in the group of nonstoichiometrical apatites with $\text{Ca/P} < 1,67$. This spectrum can be used as the indicator of calcium deficiency and the presence of HPO_4^{2-} -group in the structure. The organic radical HCO is registered in the non-stoichiometric carbonate-apatites with phosphorus deficiency ($\text{Ca/P} > 1,67$). The presence of different ion-halogen (F, Cl, OH) and oxygen in the form O^- at the axes G_3 leads to the formation of different complexes: $\text{F}^--\text{O}^--\text{F}^-$, Cl^--O^- , $\text{Cl}^--\text{O}^--\text{Cl}^-$, $\text{F}^--\text{O}^--\text{Cl}^-$, OH^--O^- . The EPR-spectra parameters of the above-mentioned centres are presented.