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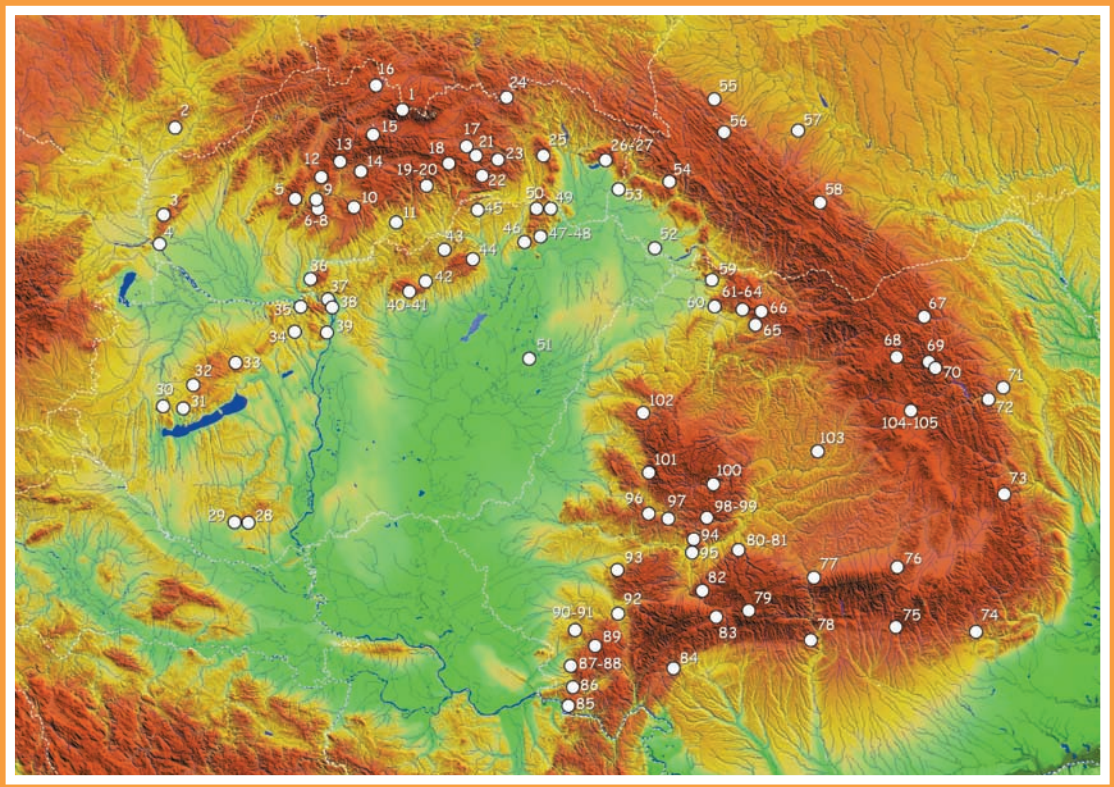
Volume 6 2010

IMA2010

20th General Meeting of the International Mineralogical Association
21–27 August, 2010

Budapest, Hungary



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On the cover: Map of the Carpathian region with type localities of new mineral species, rocks, fossil resins and hydrocarbons discovered in (first described from) the area, including both valid and discredited species. See the last page for the locality names corresponding to numbers. Map plotted by Ferenc Mádai from the data of Gábor Papp for the exhibition of the Hungarian Natural History Museum, entitled "There is something new under the earth", organised on the occasion of IMA2010.

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ABSTRACTS

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Crystallization properties of Nb containing bioactive phosphate glass-ceramics

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Glass-ceramics are relatively new material. Glass-ceramics have higher solubility than ceramics and higher mechanical strength than glass. Both properties are important for using material as implant material and depend on crystallinity properties.

In this research glass-ceramics were obtained by crystallization of previously produced glass powder. The aim of research was to compare crystallization data given by differential thermal analysis (DTA), X-ray powder diffraction (XRD), infrared spectroscopy (FT-IR) and RAMAN spectroscopy. Samples contain transition element niobium which can replace either cation, either P in anion. Hence scrupulous investigation of processes is requested.

Materials investigated in this research were niobium and sodium containing calcium phosphates. Glass powders were melted from batch of analogous composition but using different techniques. FT-IR results indicate that glass structures differ a lot.

Crystallization temperatures were detected by DTA. 8 of samples crystallize above ~800°C, only 3 samples around 720°C. Glass transition temperatures for all samples are close to 650 degrees. In literature it is shown that glasses in pure P_2O_5-CaO-Na_2O system or with TiO_2 [1] or with ZnO [2] additives start to crystallize at 650°C. It can be concluded that Nb_2O_5 additives increase crystallization temperature, although crystallizing phases mainly are the same: $Ca_3(PO_4)_2$, $Ca_{10}Na(PO_4)_7$, $Ca_2P_2O_7$ and also $Na_4(Nb_8P_4O_{32})$, $NaNbO_3$.

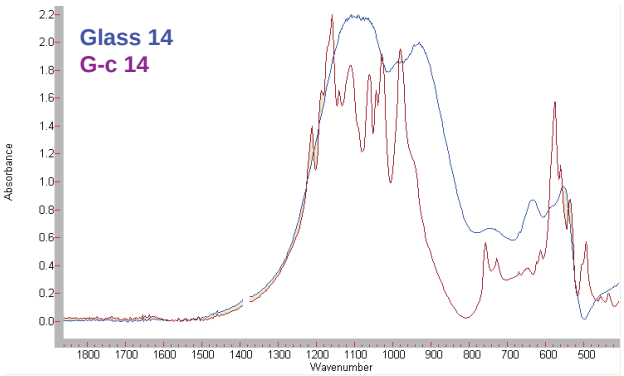

Fig. 1: Comparison of IR spectra of phosphate glass and glass ceramics.

Crystallization starts at lower temperature than temperature when first exothermal peak in DTA occurs. There are different intensities and temperatures of exothermal peaks but structures detected by XRD are almost similar. For more detailed investigation FTIR (Fig. 1) and RAMAN spectroscopy are used.

It was found that crystallization of every single phase does not have a corresponding DTA peak. In XRD pattern and IR spectra it can be seen that crystallization starts at lower temperatures than are exothermal DTA peaks. The DTA peaks can be explained by changing oxidation state of niobia. For all samples and all temperatures multiple crystalline phases are forming.

[1] Kasuga, T. (2005) *Acta Biomater.*, **1,** 55-64. [2] Cai, S. et al. (2009) *J. Non-Cryst. Solids*, **355,** 273-279.