INFRARED ABSORPTION OF TEKTITES, IMPACTITES AND OBSIDIANS AS A GENETIC CRITERION.

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Conditions of formation for three main types of natural glasses (tektites, impactites and obsidians) expose with the various degree of truth. Infrared spectroscopy is a high informative method for study noncrystalline materials (1), however natural glasses have been poorly studied using this method.

Authors had studied a collection of natural glasses composing of 4 australites, 2 philippinites, 4 moldavites, 5 indochinites, 10 obsidians, 22 impactites (from Kara and Elgygytgyn astroblemes, USSR) and 6 synthetic glasses, which were obtained from liparite with melting in vacuum (10^{-6} torr) and T = 1500-2500°C. IR-spectra (IRS) were studied on spectrofotometr UR-10 in an interval 400-1300 cm^{-1} (2,3).

IRS of natural glasses have a clear distinction between the tektites and the obsidians (Fig. 1). Impactites have an intermediate position between them. Two intervals at the IRS are the most important for judgement about conditions of natural glasses formation.

1) Absorption band in region 1000-1200 cm^{-1} depends on intensity of the melt polymerization. The more degree of polymerization the better expressed this band (1,4). Its intensity diminishes with the rise of intensity the overhear over the liquidus and this feature has well preserved in the process of rapid quenching of melt (1, 5, 6) (Fig. 1 spec. ΘK-3, 4). In that way the absorption band 1000-1200 cm^{-1} gives the possibility to distinguish tektites (T_{melt} > 2500°C, rate of quenching > 100°C x sec^{-1}) from obsidians (T_{melt} < 1200°C, rate of quenching < 10-20°C x sec^{-1}).

To estimate of rate of quenching it is very important a doublet 780-800 cm^{-1}, which is kept at 50°C x sec^{-1} (Fig. 1, spec. ЭK-3,4) and disappears higher than 70-80°C x sec^{-1} (Fig. 1) (5).

2) Absorption band in region 540-600 cm^{-1} connected with O-Si(Al)-O and O-Si-O vibration are seen only when the melt have a comparatively low T^{o} or in the process the slow cooling (7). These absorption bands are absent for tektites, oligatory for obsidians and present for impactites only when they are cooled slowly.

Previous study of impact glasses of Kara (2, 8) and Elgygytgyn (8) astroblemes demonstrated that the small bombs (<0.1-0.5 m) composed of dense clean glass have IRS like tektite (Fig. 1, spec. Э-4a, 26a, Y-3-9r, 4c, et al.) but the impactites from big bodies have IRS like obsidians (Fig. 1, spec. Э-29a, Y-5-1,3 et al.) or even liparites (Fig. 1, spec. Y-5-15,17).

IRS of indochinites from the region Ho Chi Minn - Bien Hoa (Soc. Rep. Vietnam) (Fig. 1, spec. B-1a, 2, 4, 5, 6) is rather impactites than tektites (Fig. 1, spec. A, Φ , M) and it is possible support hypothesis on large astrobleme in this region (9). It is very probably also because in indochinites the diaplectic minerals, coesite and nickel-iron were discovered (10).

In that way, the level of complexity and variation of intensity absorption bands of IRS of natural glasses can to be a criterion for estimate of temperature and rate of quenching of melt. And so we can distinguish the products of quenching endogenic (obsidians) and impact, cosmogenic tektites and impactites) melts, if the latters were quenched as small objects.

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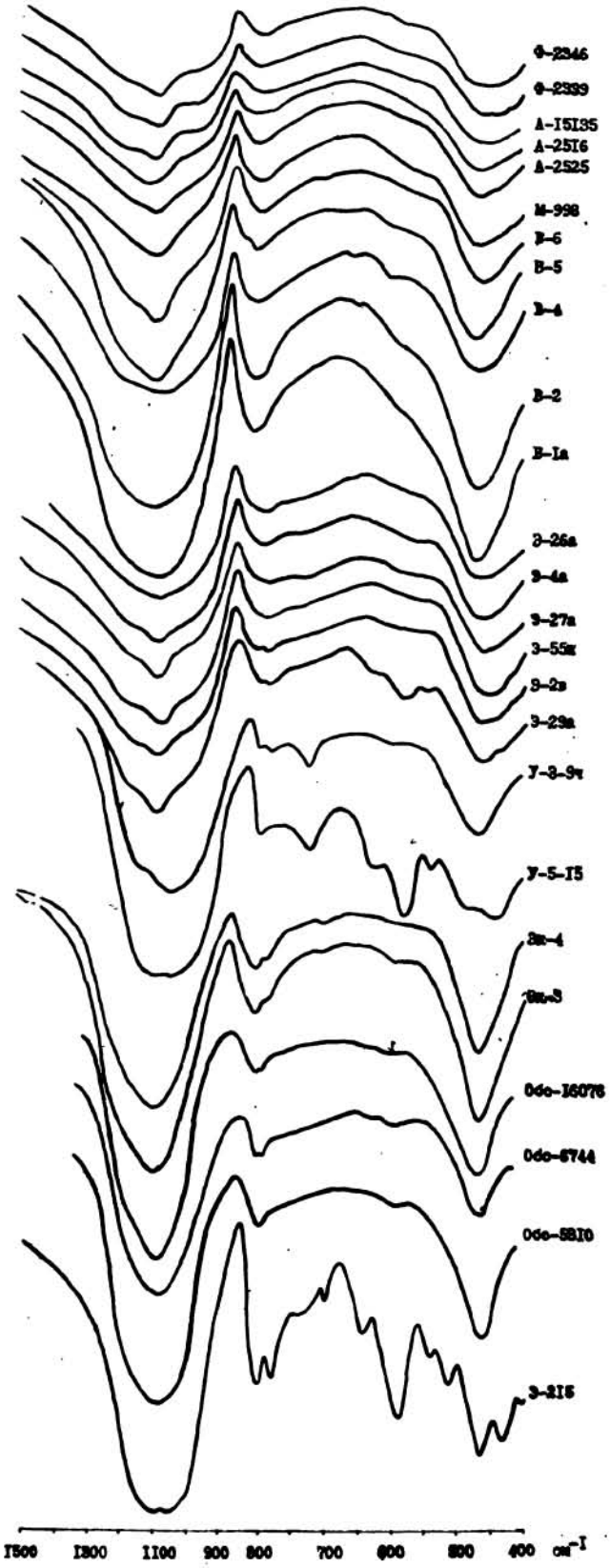

Fig. 1. Infrared absorption spectra of tektites, impactites and obsidians. A - australites, Φ - philippinites, M - moldavites, Э- impactites from Elgygytgyn, Y - impactites from Kara, Эk - synthetic glasses, Э-215 - liparite.