# TRANSFORMATIONS OF QUARTZ-PLAGIOCLASE-GARNET-CLINOPYROXENE ROCK IN SPHERICAL STRESS WAVES.

L. Sazonova, Moscow State University, Geological Department, Moscow, 119899, Russia. E.Kozlov, Yu.Zhugin, Russian Federal Nuclear Center - Research Institute of Technical Physics, P.O. Box 245, 456770, Snezhinsk, Russia

Quartz-plagioclase-garnet-clinopyroxene rock undergoing transformation in spherical stress waves have been investigated. The impact metamorphism of the rock undergoing shock pressure from 20 GPa to 2000 GPa at the radius of 24 mm has been studied. The Px high density relicts have been found in the rock.

Q-Pl-Gr-cPx rock in the form of the full sphere with 48.88 mm diameter has been subjected to welding in vacuum in the hermetically seald jackets of stainless steel 12C18N10T. This sample has been subjected to loading by the converging detonation of the spherical layer of high explosive. The scatter of the explosion products has been restrained by the case of steel.

In the experiment the sample has been subjected to an extremly wide range of pressure, temperature and energy density. After the explosive loading the hermetically sealed ball was cooling at the rate of $10^8$-$10^9$ degree/second. Then it was cut along the meridian plane by the diamond saw.

The rock undergoing different impulse loading along the redius (from 20 GPa to 500-2000 GPa at the distance of 23 mm) has been investigated by Scanning Electron Microscopy with energy-dispersive analyzer (An-10000),X-Ray Diffractometry, Universal Stage.

In the material of the ball undergoing the loading of the converging spherical stress waves the appearance of five characteristic zone along the radius has been found.

I zone. The pressure in this zone at the front of the converging spherical stress wave is estimated as 20-25 GPa. Rough faults in all minerals are characteristic of this zone. There are numerous small veins of pseudotachylites which are microfragment breccia with glass matrix.

II zone. The calculated pressure are 25-37 GPa. The characteristic feature of this zone is appearance of faults in garnet and planar features and planar elements (parallel deformation zones) in pyroxene, plagioclase, quartz. Diaplectic glass often substitutes quartz.

In this zone the application of quartz geobarometer for the definition of mean shock pressure in the rock became possible due to a great number of planar elements in quartz [1]. This pressure is 32 GPa. This datum well correlates with the calculated ones (35-37 GPa).

In this zone there are characteristic features showing the pyroxene partial melting and its moving.

III zone. The calculated pressure at the front of the converging spherical stress wave was 40-80 GPa. In this zone the

initial general texture picture is preserved. But there are signs that all quartz and plagioclases were in a melting state there but only quick quenching and high viscosity did not result in general melt mixing. Partial Px melting but in - greater intensive quantities than in II zone is observed. In garnet there are a great number of faults along which fluidal glasses of garnet composition often appear.

IV zone. The calculated pressure in this zone are from 75 to 180 GPa. This is a zone of almost full rock melting with instantaneous partial crystallization from the melt (or condensation from a gas phase). Different mineral melts are intensively mixing in IV zone unlike III zone. It is probably connected with the fact that the formed melts were less viscous and had higher temperature.

Pyroxene is often present in the form of unmelted relicts especially at the beginning of the zone. Numerous planar lamellae develop in some pyroxene relicts. Intermitient dark and light lamellae (width 1-10 mkm) are observed in SEM. These planar lamellae have distinct crystallographic orientation investigated by us with the help of universal stage. They develop in one or two orientations, in the latter case crossing at the angle of $45^{o}$ or $67^{o}$. Planar lamella orientation crossing at the angle of $67^{o}$ is close to that of crystallographic planes (001) and (100). Planar lamella orientation crossing at the angle of $45^{o}$ is close to that (122) and (010).

Dark light lamella composition differ in Fe and Mg contents. High density Px phase decomposition probably took place there resulting from the high pressure relaxation. Fe and Mg lamellae in Px were formed when high density Px phase was transformed into normal Px. The following factors show that the high density Px phase had been present: 1) for Px relicts in this zone decrease of the angle $2V_{N_g}$ to $50^{o}$ in comparison with $62^{o}$ for unchanged Px from I zone, 2) For Px from this zone decrease of elementary crystal cell volume to 447.80 in comparison with the value 452.71 for unchanged Px.

All these facts show that not only the Px crystal lattice decomposition (this process was undoubtedly present and dominent and resulted in Px melting) but Px crystal lattice reconstruction (this process resulted in the appearance of high density Px phase) have taken place.

Tiny needles were crystallized from the Px melt where it was not mixed with other mineral melts Newly formed Px is always more Mg-rich i.e. has greater crystallization temperature than the initial Px. It cannot be excluded that the newly Px resulted from the gas condensation appearing at very high shock temperatures.

V zone Mega bar pressures are characteristic of this zone. Here all the material is in glass state which is the result of full melting or condensation from the gaseous state.