

NEW UNDERGROUND MELTING PROCESS FOR SPACE RESOURCES BY SHOCK WAVE.

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1. Introduction: There are previous underground melting processes of terrestrial crust by 1) direct magmatic melting with rock pressure with volatile elements, or 2) volatile melting with rock pressure along subduction region after shock wave of earthquake events. Both melting process can be explained mainly in water and air Earth planet, which cannot be applied to other planetary crust or mantle without any dynamic cycles of volatile-bearing fluids. This is mainly because such light volatile elements cannot be considered to be transported to the interior by progressive smaller impact processes due to major evaporation without huge impact process to the deeper interior as main dynamic process of the volatile-bearing process mainly at the primordial periods of the formation. The main purpose of the present paper is to make clear new types of underground melting process with volatile-bearing fluids without main dynamic cycle of subduction at water Earth planet, which can be applied for other planets with space resources as new mineral formations [1, 2].

2. Underground melting processes: From the present ore-deposits and magmatic melting formation sites, almost all underground melting processes on water and air Earth planet is restricted to the margins of continents where many plates with water and volatile elements are subducted and transported to the interior and followed any earthquake by shock waves with slide destruction the rocks. This main formation processes are found in old continental margins during the continental drift events, which is found in the inside the present continents and island after repeating the continental collisions and separating. Therefore mineral ore formations by magmatic melting and evaporation processes on the dynamic Earth planet are found at the present location with irregular distribution after dynamic surface changes by continental drift as follows:

1) Small and localized ore deposits by random melting processes with deep rock pressure with volatile elements, which are found almost all locations related with continental drift movements, or
2) Limited ore deposits by volatile melting with deeper rock pressure along the subduction regions after shock wave by earthquake events, which are found mainly at the margin of the subduction at the continents and islands (Table 1).

Table 1. Two types of ore deposits of water Earth

1) Localized distribution by random melting.
2) Limited distribution along subduction melting.

3. Mineral deposits with carbon-bearing fluids:

Although it is considered to be deeper origin of diamond carbon sources of deeper interior of the terrestrial mantle, but prompt uplift process with long tube-like structure without severe melting process is not discussed so well the fundamental problem during the uplift-process of the diamond carbon ore deposits.

Recently, author has reported that the Congo diamond is considered to be melted at the shallow crust by shock wave explosions due to materials evidences by nano-particles of carbonates and halites in composition (Table 2).

Author also collects recently new analytical data of various ore and rock-forming minerals with carbon-bearing compositions in the various samples of the Earth and meteorites of the Moon, Mars and asteroids, which are checked the contribution of interior fluids with carbon-bearing materials (Table 2).

Table 2. Models of mineral deposits of carbon-bearing fluids.

1) <i>Shock-wave melting at shallow crust:</i> Congo diamond (with nano-grains with carbonates and halites).
2) <i>Carbon-bearing nano-grains by shock wave-explosions:</i> Mineral ores of the Earth, Moon, Mars and Asteroids.

4. Melting by shock-wave explosions at the crust: Uplift process of fluids and gas with high pressure in crustal rocks induced by shock-wave explosions (called as “volcanic-like process” mainly in the Earth planet), is formed in the following processes (Table 3):

1) *Surface melting by meteoritic impacts:* Crater structure on the surface rocks which is formed by gravitational collision with shock wave (more than sound velocity) are considered to be surface melting process observed at all planetary bodies [1-3] (Table 3).

2) *Underground melting by rock-high pressure:* Underground melting by shock wave under of rock-high pressure are formed mainly at fault-sliding rocks mainly by a) high pressure process in the solid rocks with carbon-bearing fluids (called as “earthquake” as final event), or b) high pressure explosion mainly by the light-elements (hydrogen or carbon)-bearing gas or liquid materials (called as “volcanic-like explosion” as final high-temperature with evaporated gas fluids) [4-9].

Table 3. Two types of melting by shock-wave explosions.

1) <i>Surface melting</i> : Mainly by meteoritic impacts.
2) <i>Underground melting by rock high-pressure</i> : Earth-quake-type or carbon-bearing fluids explosions.

5. Multiple melting processes with fluids: Melting process of fluids with gas under high pressure in crustal rocks induced by shock-wave explosions (called as “volcanic-like process” mainly in the Earth planet) is formed in the following processes (Table 4):

1) *Plate-tectonic sliding process at water and air Earth planet*: Fluids with gas of water and air Earth planet are transported by plate-movements at subduction and ridge fronts as cyclic material processes. “Mud-volcano (small volcanic process with mudstones at shallow crust)” with liquid and gas evaporation process is observed mainly at earthquake shock-wave regions of the Earth which is classified as wide-cyclic process of water-rich planet [10].

2) *Underground fluid explosions at any planetary bodies*: Fluids with gas at underground rocks (not only by plate-movement, but also by previous stored process on early planetary impacts with small to giant sizes) are broken by high-pressure of shock-wave, which are formed at any planetary bodies (including Asteroids) by one of shock-wave process in the interiors (Table 4) [10].

Table 4. Fluid with gas melting in the interior rocks.

1) <i>Plate-tectonic sliding process</i> : Fluid-rich Earth planet.
2) <i>Interior fluid explosion</i> : Water-poor planetary bodies. (including the Moon, Earth, Mars and Asteroids)

6. Ore resources formed by melting process:

The following is proposed formation process of ore resources by multiple melting processes with fluid-gas processes at the interior of any planetary bodies [10] (Table 5).

1) *Water fluids for melting process at plate-boundaries*: Water liquids of water Earth planet transported along subduction plate-boundaries are easily evaporated to form water vapors at the shallow interior, which are inevitable to form any ore deposits by multiple melting process at active Earth planet.

2) *Carbon-rich fluids for melting process at any interior*: Carbon-rich gases of any planets are changed to fluids at rock high-pressure conditions under the interior at any planetary bodies, which are inevitable to form any sizes from nano- to km-sized ore deposits by multiple melting process at impact-continued planets from small to large sizes, or huge impact processes at asteroids or planetary sized bodies.

Table 5. Multiple melting types of ore resources formations.

1) <i>Water fluids melting process</i> : Plate boundaries evaporations for multiple melting at fluid-rich Earth planet.
2) <i>Carbon-bearing fluids for melting process</i> : Carbon-rich gas changed to fluids (in all type space bodies).

7. Application of multiple melting with fluids:

The present model of multiple melting by fluids with gasses can be applied to produce space ore resources not only at water-rich planet Earth but also at water-poor planetary bodies of the Moon, Mars, Venus and Asteroids etc. [10].

8. Summary: The present results are summarized as follows [10]:

1) There are two types of ore deposits of localized random melting and limited subduction melting of water Earth planet.

2) There are two types of mineral deposits of carbon-bearing fluids at shallow shock-wave melting and shock-wave explosions.

3) There are two types of melting by shock-wave explosions at surface meteoritic impacts and interior melting by rock-pressure with carbon-bearing fluids.

4) There are two types of fluid with gas melting in the interior rocks of plate-tectonic sliding process, and interior fluid explosion as space resources.

5) There are two types of multiple melting types of ore resources formations by water fluid melting system and carbon-bearing fluids for melting process, which can be applied as formation of space resources.

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