

THERMODYNAMIC CALCULATIONS OF VENERA/VEGA MAGMA CRYSTALLIZATION TRENDS USING COMAGMAT SOFTWARE: PRELIMINARY RESULTS. A. M. Abdrakhimov, Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences, Russia, Kosygina St. 19, 119991, Moscow, albert@geokhi.ru.

Introduction: Soviet landers Venera 8, 9, 10, 13, 14, and Vega 1 and 2 made geochemical analyses of Venus' surface materials [1] and this is the only direct geochemical information about Venus' surface. For Venera 13, Venera 14 and Vega 2 surface materials major petrochemical elements were measured by XRF (without Na₂O). All studied materials are close in their chemistry to terrestrial basalts. The goal of this work is to trace the trend of equilibrium crystallization of Venus magma and compare with those for terrestrial oceanic from three tectonic magma generation environments.

Data and results: The Venus material analyses were recalculated to obtain sulfur-free compositions. The thermodynamic software COMAGMAT was used for simulation of equilibrium crystallization [2]. The following parameters have been assumed: QFM oxygen buffer, 0% H₂O, isobaric crystallization. The simulations run for different sodium abundance.

The results of modeling are shown in Fig.1.

Vega 2 magma crystallization scheme is the next: melt + olivine, melt + olivine + plagioclase, olivine + plagioclase.

Venera 13 magma crystallization scheme is the next: melt + olivine, melt + olivine + magnetite, melt + olivine + magnetite + plagioclase, melt + olivine + magnetite + plagioclase + ilmenite, melt + olivine + magnetite + plagioclase + ilmenite + augite, melt + magnetite + plagioclase + ilmenite + augite.

Venera 14 magma crystallization scheme is the next: melt + olivine + plagioclase (subcotectic), melt + olivine + plagioclase + augite + pigeonite.

We compared the resulted trends with those found for compositions of terrestrial unaltered magmatic rocks for three typical tectonic environments: mid ocean ridges, ensimatic ocean island arcs, and oceanic hot spots [3-5].

Venera 14 magma evolution trends are close to tholeiitic ones of mid-ocean ridge basalts. It is different from the oceanic island arc basaltic rocks in relatively quick titanium enrichment. Venera 14 trends differ from the oceanic hot-spot magmatic series in aluminum depletion.

Venera 13 magma crystallization is characterized by high-potassium trend, which strongly differs from

the trends of the mid-ocean ridge magmatic series and from the ocean island arc magmatic series trends, and close to the ocean hot-spot trends.

Vega 2 magma evolution trends are characterized by very low enrichment in titanium, which differs from the ocean hot-spot magmatic series trends. Vega 2 trends differ from those of MORB in high Al₂O₃ and low CaO abundance. They are more close to ocean-island arc tholeiitic trends, especially for the magnesium varieties, such as boninites.

Implication: The Venera 14 magma melt is close in its composition to MORB tholeiites, typical series for the spreading tectonic environments. Venera 13 magma is close in its composition to the alkaline magmatic series of the terrestrial hot-spot tectonic situation.

Unexpected result of this simulation is that Vega 2 magma is rather close to the tholeiitic series of ensimatic Ocean Island Arcs, the typical terrestrial recycling environment. But this may also be due to potentially large errors of the Vega 2 measurements: sum of components in the published analysis is significantly smaller than 100%. The Magellan mission data showed no evidence for global plate tectonics on Venus, including absence of the island arc-like geologic structures. It is possible that Vega 2 magma generation could be due to recycling mechanics related to corona formation [6].

Acknowledgments: Author thanks A.A. Ariskin and A.T. Basilevsky for stimulating discussions and help in the work.

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