

Hot spots and seamounts line from North Atlantic ocean – estimation of the petrochemical composition and evolution of volcanic activity by the GIS 3-D model.

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Abstract

There are 3-D models of the volcanic from the Tenerife island, other hot spot line (seamounts) from the Atlantic ocean were observed. Trends of volcanic activity from these objects were constructed. The total correlation between intraplate magmatism and oceanic tholeiitic floor magmatism discussed.

Introduction

The aim of the work is found the better methods of estimation characteristic of the total composition of the intraplate source magmatism and its activity. Many researchers the composition of the high-MgO lava flows or composition of the mantle nodules is used as the bases for estimation mantle source composition. From the other side during the evolution of the magmatic system on the island the composition of the lava flows varied dramatically. For this reason the question of the whole composition of the hotspot (as volcanic island object) is open now. We take quite a different approach from that used the calculation of the mean composition of the stratigraphic units on the island volcanism, measurement of the lava flows square and volume and only after that calculate the whole composition of the hot spot (island) source. Other question is the evolution of magmatic system as some limited object. There is no direct measurement of the volcanic activity during all the life activity of the hot spot.

Tenerife

Our data were collecting on the S.V. “Academic Boris Petrov” 1988 year. We take probe on the main stratigraphic units. As addition we used analysis from database “GEOROCK” [1], and PROBE [2]. All data set consist about 600 silicate analysis of the rocks. We scan published geological map and section M 1:100000 for created e-map from the island Tenerife. There is the simplistic 3-D model [3-5] by the Arc/INFO v8.0 software of Tenerife on the fig 1. Only 3 main series exposed on that figure – old Anago-Teno series, Series III (Velaflor series), Recent volcanic series (Teide). There is isobata -2000m included in our model, as

basement of Tenerife island, ancient series. We believed that it composed from the tholeiitic series. There are total decrease of the volcanic activity during evolution from km^3 - 4200 tholeiitic basement, 1770 Anagi series, 1200 Vilaflor, 80 recent lava flow (fig.2). We believed that this is common situation from the oceanic islands. There is the quantity of the intraplate magmatism object from oceanic region is increased, but the volume of the volcanic product decreased. As from the composition of the intraplate oceanic magmatism, our investigation showed that the part of the alkaline melts on the island lesser than tholeiitic and high MgO – picritic and alkaline basalts melts.

Seamounts chains

The same methods we used from the several volcanic line from the North Atlantic. We observed the - New England, Serre Leone, Horseshoe and Corner line seamount chains. And we can estimate the evolution of the hot spot moving as volcanic activity variation from the one seamount volcano to other. The preliminary results show us that there is some periodical activity of the hot spot magmatism. We try to connect this periodical law with age of intraplate volcanism (fig 3). Unfortunately we don't found some kind of numerical solution of this law now. But we believed that it solution must be exist. May be we need more time and initial date for this problem. Also we used our database for calculate histogram of intraplate placements and age measurements. Certainly it is a very draft estimation, but on the fig 4 we see clear that total activity increase to recently period. The same result were published Juleva E.V. [6] from all oceanic seamounts. We calculate square of oceanic floor with different age and build the same histogram. We used the geological map of Atlantic ocean with seven age intervals - N_1 -Q; Pg_3 - N_{1-2} ; Pg_{1-2} ; K_{1-2} ; K_2 K_1 ; J_3 . The polygons' boundary is the linear magnetic anomalies - LMA1-49. We use following rough estimates of volcanic activity function in ages as initial assumptions for solving that problem:

1. The intraplate magmatism age of the island or seamount usually has some interval (about 0-10 mln. year). This could be explained by the system methodic errors, which appear after using the different analytical methods. The reason could also based on the complicate history of hot spot evolution. We use maximum age magmatism estimation, which is closer to the starting position of volcanic activity.
2. It is supposed that our data base age setting directly corresponds to the Atlantic Ocean intraplate magmatism volume. We could not have other correctly function using only the location where age volcanism measurement exists.

The present results of the comparison of this histogram are quite perspective. The global shift of the alkaline magmatism activity was discovered relatively tholeiitic magmatism.

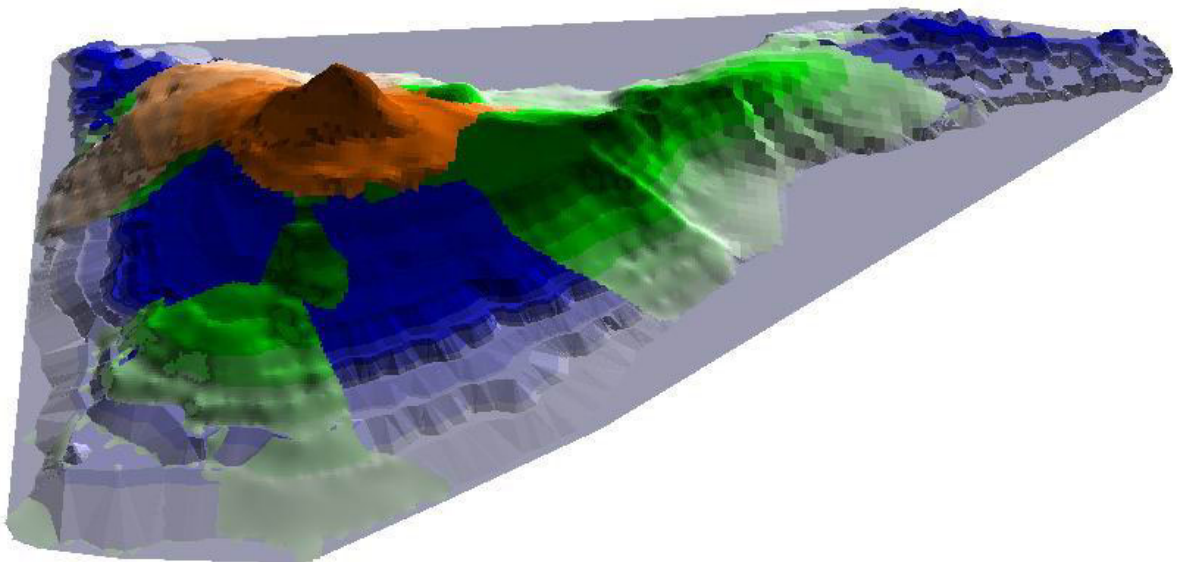
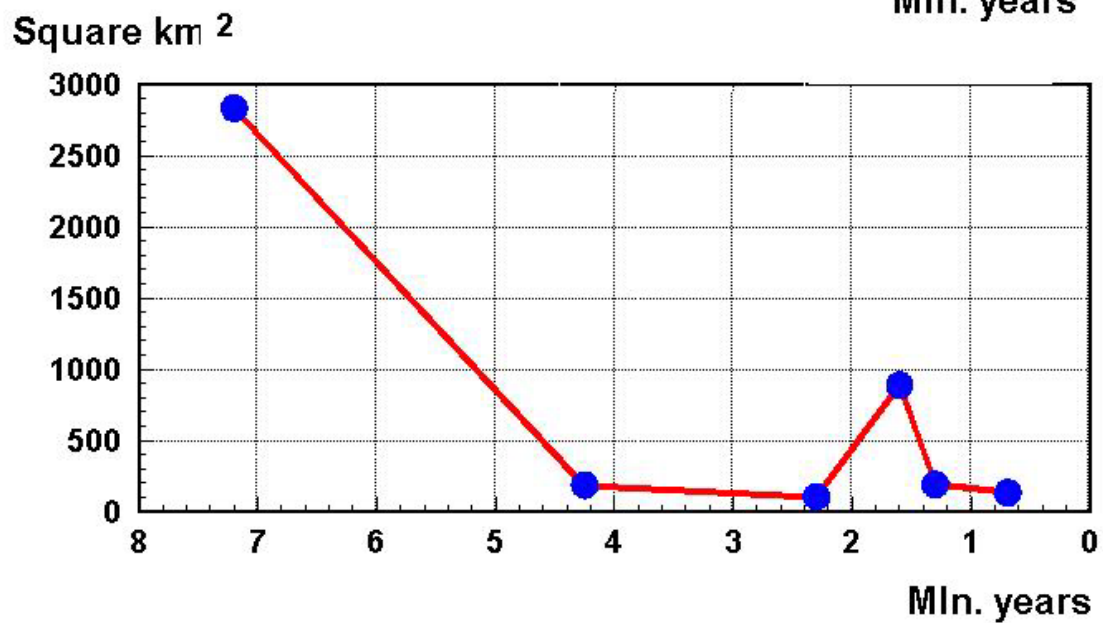


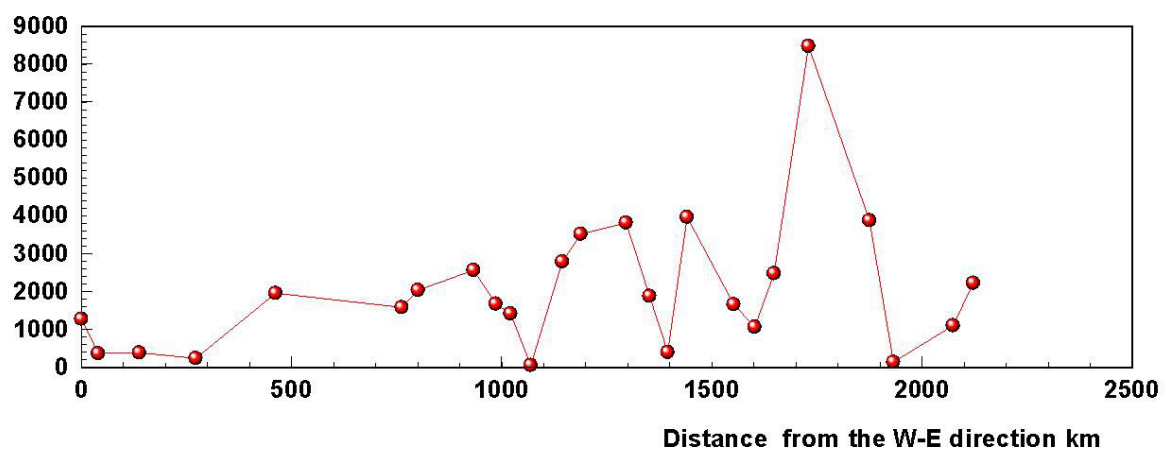
Figure 1 3-D Model volcanic activity from the Tenerife island.



Evolution of volcanic productivity from the Tenerife island.

Figure 2 Evolution of volcanic productivity from the Tenerife island.

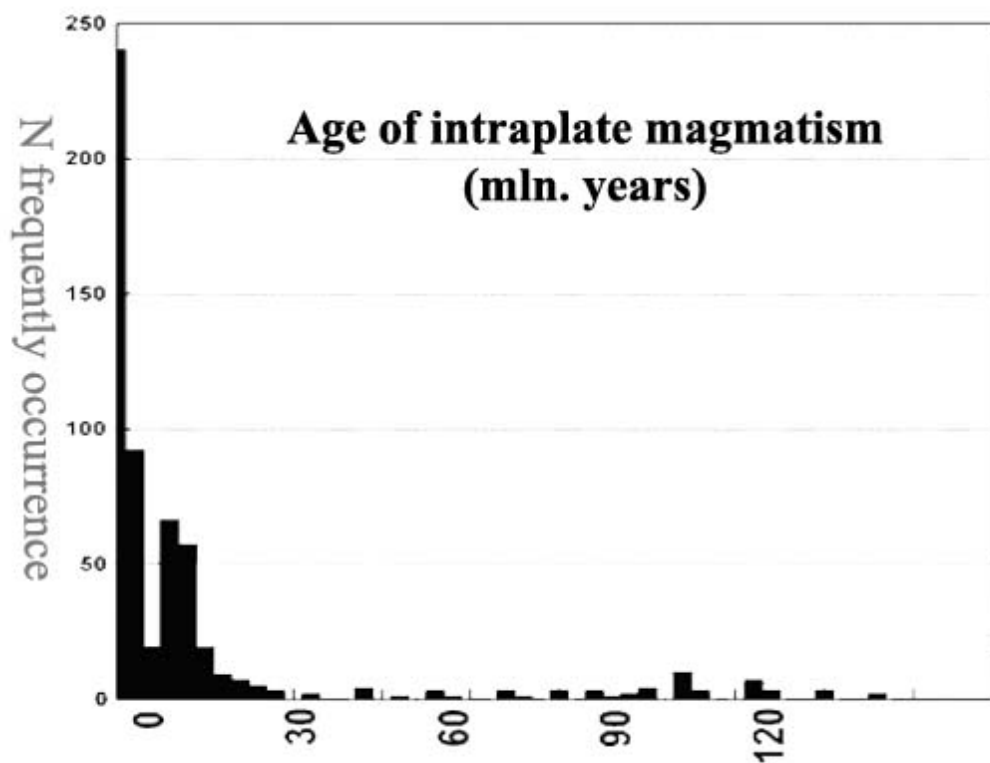
Volume of seamount



The oscillatory law of the hot spot activity from the New England s.m. line.

figure 3

Figure 3 The oscillatory law of the hot spot activity from the New England s.m. line.



Histogram of the Atlantic tholeiitic magmatism

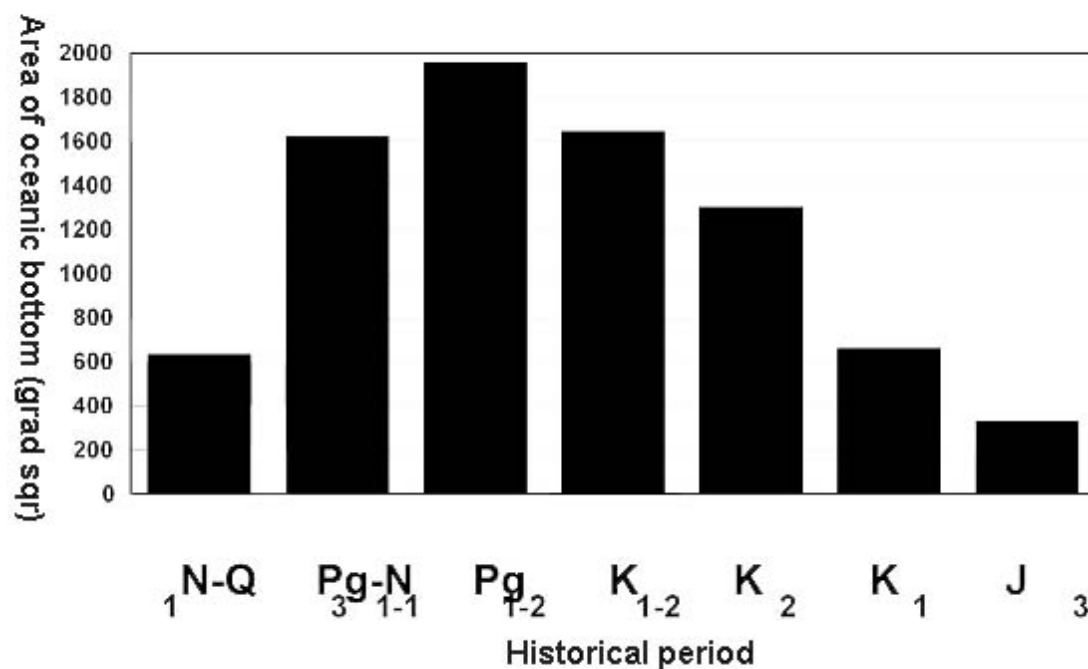


Figure 4 Histogram of frequently occurrence of the Atlantic Ocean intraplate and tholeiitic magmatism from Atlantic ocean.

References

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