THERMAL MODELING FOR BASALTIC DYKES OF TRÊS RIOS - RJ

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RESUMO: This paper presents preliminary results of thermal models that have been developed based on tholeiitic basaltic magmatism of Early Cretaceous age which occurs in the region of Três Rios, inserted into Serra do Mar Dyke Swarm. We use the solution of the equation of temperature T in Cartesian coordinates in time and space:

$$\frac{\partial T}{\partial t} = \frac{k}{\rho c_p} \nabla^2 T$$

where k is the thermal conductivity, cp is the specific heat and ρ the density of the material.

To find the solution of the equation we used the method of separation of variables with the following contour conditions: temperature T would be equal to the temperature of the host rock T_1 to a time t equal to zero and distance x from the center of the dike equal to zero; temperature T equal to the temperature of the magma T_0, for $t > 0$ and $x = 0$, T tending to T_1, for $t > 0$ and x approaches infinity. The value of 1000 ° C was used for the magma temperature at the same time in that we consider the existence of a large temperature contrast between this temperature and the host rock's temperature, considering the latter equal to zero. Thus, it was obtained the following solution, which considers only half of the thickness of the dyke:

$$T = \frac{T_0}{2}\left[erf\left(\frac{x}{2\sqrt{\kappa t}}\right)\right]$$, where $$\kappa = \frac{k}{\rho c_p}$$

The models provide results which relate temperature, distance and time. The interpretation of these data shows the importance of the time parameter in determination of the necessary time for the thermal equilibrium between the intrusion and the host rock. Additionally, it is possible to observe the dissipation of heat flow through the country rock in function of the distance at which the heat associated with the dyke is able to influence the temperature of the host rock.

The development of these models is performed based on dykes that have different thicknesses. In the case of dykes whose thickness is less than 5 meters, the time required for thermal equilibrium with the host rock is approximately 10 years, since it can be influenced at a distance of up to 60 meters from the center of the dyke. In the case of the basaltic dikes that have values of thickness slightly larger than 10 meters, thermal equilibrium between the dikes and country rock occurs within 100 to 200 years, enabling regions to a distance of just over 250 meters are influenced by these thermal dykes. In dykes presenting greater thicknesses ranging from 20 to 50 meters, an interval between 1000 and 1500 years corresponds to the time required for the occurrence of thermal equilibrium. In this latter situation, the contact time between the dyke and host rock permit that heat associated to dykes reaches distances of more than 500 meters from the center of them

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