# PETROGRAPHY AND GEOCHEMISTRY OF PROTEROZOIC MAFIC DYKES FROM THE GUIANA SHIELD, NORTHERN AMAZON CRATON

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At the end the early Proterozoic Trans-Amazonian orogeny a large number of basaltic dykes and sills intruded the Guiana Shield, northern Amazon Craton (Fig. 1). Some of these are to be found as unmetamorphosed differentiated bodies in the Roraima Group sandstones in the northern part of the shield, whereas many unmetamorphosed dykes intrude granitic rocks and metamorphosed volcano-sedimentary sequences of the Proterozoic greenstone belts of the northern Guiana Shield. These middle Proterozoic dykes have been shown to be the result of basic magmatism after the consolidation of the shield (PRIEM et al., 1969; BERRANGÉ, 1972). Previous investigations concerned solely with these dykes and sills are those of RUST (1963), HAWKES (1966), HARGRAVES (1968), PRIEM et al. (1969), CHOUDHURI & MILNER (1971) and De ROEVER (1975). In Venezuela, BELLIZZIA (1975) studied the chemistry of similar dykes. More recently GIBBS (1987) dealt with mafic intrusions in the northern Amazon Craton, contrasting the styles of Proterozoic and Mesozoic dykes, while SIAL et al. (1987) presented some of the Proterozoic dykes in a regional compilation of mafic dykes in Brazil.

Texturally, the middle Proterozoic dyke rocks are aphyric and non-cumulate and are typically fine- to medium-grained, ophitic to sub-ophitic. They consist of plagioclase ($An_{49}$ to $An_{57}$) and a combination of the pyroxenes hypersthene, augite and pigeonite. Occasional accessory minerals in very minor amounts are brown biotite, pale green hornblende, apatite, quartz and micropegmatite mesostasis; olivine is a very rare accessory mineral and is generally altered to iddingsite. Ore minerals identified are ilmenite, magnetite, pyrrhotite, pyrite, chalcopyrite; some others of somewhat doubtful identification are tennantite, pentlandite and cubanite.

Major element distribution for these dykes with reference to the mafic index, FeO*/FeO* + MgO x 100, indicates an approximate "differentiation trend" similar to that obtained by HAWKES (1966) for a differentiated sill. However, since the dykes are separated from each other by several tens of kilometers to over 100 km, there is no geographical link between them, so that the trend is an indication of a mechanism whereby their intrusion took place in batches after varying degrees of differentiation in magma chambers. Figure 2 shows their trend in an AFM diagram. Tectonically, such a process might be linked to an abortive attempt at continental rupture. That the crust in this part of the Amazon Craton was still weak in middle Proterozoic times was suggested by GIBBS (1987) on the basis of the forms of intrusion of the dykes and related sills. As far as trace elements are concerned, the dykes are generally low in Ti, P, and Zr; this feature, coupled with relatively high LILE and LREE, suggests derivation from a depleted mantle later enriched in the latter groups of elements. These characteristics and the low-Ti nature of the dykes are similar to rift-related Mesozoic basaltic rocks of Antarctica and Tasmania as well as island-arc tholeiites. On the other hand, the dykes are comparable to Archaean dykes of Greenland, and their $TiO_2$-$SiO_2$ correlation is

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not unlike komatiites (Fig. 3). They also resemble the Huronian basalts (JOLLY, 1987), although these have overall higher Zr contents. In Canada, JOLLY (op.cit.) noted a steady decline of Ti/Zr ratios of basalts with age due to depletion of these elements by previous volcanic events. The average Ti/Zr ratio for the Guiana dykes, assuming a mean age of 1.7 Ga, is slighly higher in comparison and might be due to the single greenstone belt event. As with the Scourie dykes, the enriched LILE and LREE may well be an indication of their source in the continental lithosphere (TARNEY & WEAVER, 1987).

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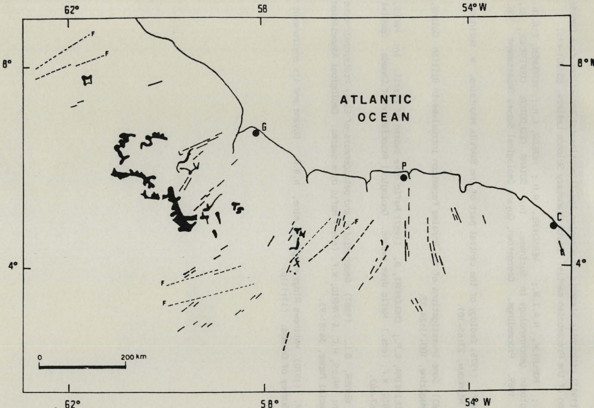


Figure 1 - Tholeiitic sills, dykes and swarms of the Guiana Shield, northern Amazon Craton. Major sills and dykes are of middle Proterozoic age and belong to the Avanavero Suite (GIBBS & BARRON, 1983); F = major faults; G = George town; P = Paramaribo; C = Cayenne; other dykes are either Late Palaeozoic, as along the Takutu Graben in southern Guyana, or Mezosoic - see SIAL et al. (1987) for a more complete compilation.

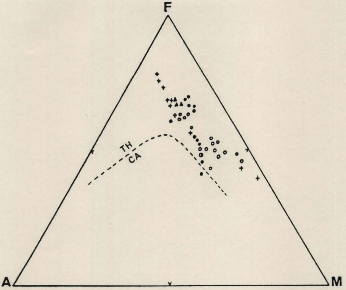


Figure 2 - FeO* - MgO - ($Na_2O$ + $K_2O$) diagram for dykes of this study: open circles - A.Choudhuri; full circles - HARRISON (1908); crosses - HAWKES (1966); triangles - GIBBS (1980); half-filled circle - WESTERMAN (1970). All references in GIBBS (1980). TH - tholeiite; CA - calc-alkaline fields from IRVINE & BARAGAR (1971).

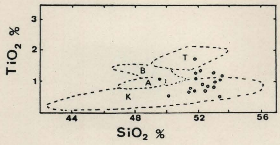


Figure 3 - $TiO_2$-$SiO_2$ variation for middle Proterozoic dykes (analyses by A.Choudhuri) compared with Ameralik A and B dykes of Greenland (GILL & BRIDGWATER, 1979), T = tholeiite flows from Munro Township (ARNDT et al., 1977) and K = komatiites from ARNDT et al. (1977) and JAHN et al. (1980).