Zeitschrift: Archives des sciences [1948-1980]
Herausgeber: Société de Physique et d'Histoire Naturelle de Genève
Band: 33 (1980)
Heft: 1-3

Artikel: Palaeogene komatiites from the ultramafic part of the Gorgona Ophiolites (Colombia)
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DOI: https://doi.org/10.5169/seals-739500

PALAEOGENE KOMATIITES FROM THE ULTRAMAFIC PART OF THE GORGONA OPHIOLITES (COLOMBIA)

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Unmetamorphosed mafic and ultramafic rocks overlain by palaeogene oceanic sediments are exposed on Gorgona Island which is a remnant of the Coastal Cordillera along the Pacific margin of Colombia (Gansser, 1950). Gorgona is one of the rare places in the world where young ultramafic komatiites exhibiting typical quenched spinifex textures occur. The spinifex rocks form lenticular bodies (?lava flows) within cumulate ultramafics and troctolitic gabbros and are closely associated with diabases and pillow basalts of tholeiitic composition.

During a rapid cooling process the order of crystallization was: olivine ($Fo_{90\text{-}91}$), high Al-calcic pyroxene and chromian spinel being the major quenched phases (Fig. 1), then olivine ($Fo_{86\text{-}82}$), low Al-calcic pyroxene, plagioclase ($An_{75\text{-}81}$), and Ti-magnetite as quenched products in the interstial groundmass (Fig. 2).

Rock composition (wt %) : SiO_2 44.2, TiO_2 0.66, Al_2O_3 12.0, Fe_2O_3 3.2, FeO 8.2, MnO 0.18, MgO 15.9, CaO 10.1, Na_2O 1.13, K_2O 0.02, P_2O_5 0.06, H_2O 4.0; trace elements (ppm): Cu 105, Ni 718, Co 93, Cr 1250, Ba <10; depleted in LREE; $100\ Mg/(Mg+Fe^{2+}) = 77.6$.

Outstanding chemical features of these rocks are the high MgO, chromium and nickel contents relative to ocean floor basalts. The olivine compositions seem to be compatible with crystallization from a liquid with magnesium-values corresponding to the bulk rock composition, giving K_D values (ol/rock) of about 0.3. We think that the unusual chemical composition of these rapidly chilled extrusive rocks

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within the close neighbourhood of oceanic crust throws new light on the petrological models of generation of ocean floor basalts.

The olivine control line in Figure 3 indicates that an olivine fractionation of 25 to 30% from a primary liquid similar to that of the Gorgona spinifex rocks could produce the evolved magmas of either olivine tholeiites or plagioclase tholeiites. A detailed petrological study and model calculation involving all major elements, Cr, Ni and some incompatible elements such as Zr, Y and rare earth suggest that to a small amount clinopyroxene and plagioclase must have been also fractionated (Cameron *et al.* in preparation).

We believe therefore that the Gorgona komatiites represent the least modified liquid generated by partial melting of the oceanic upper mantle.

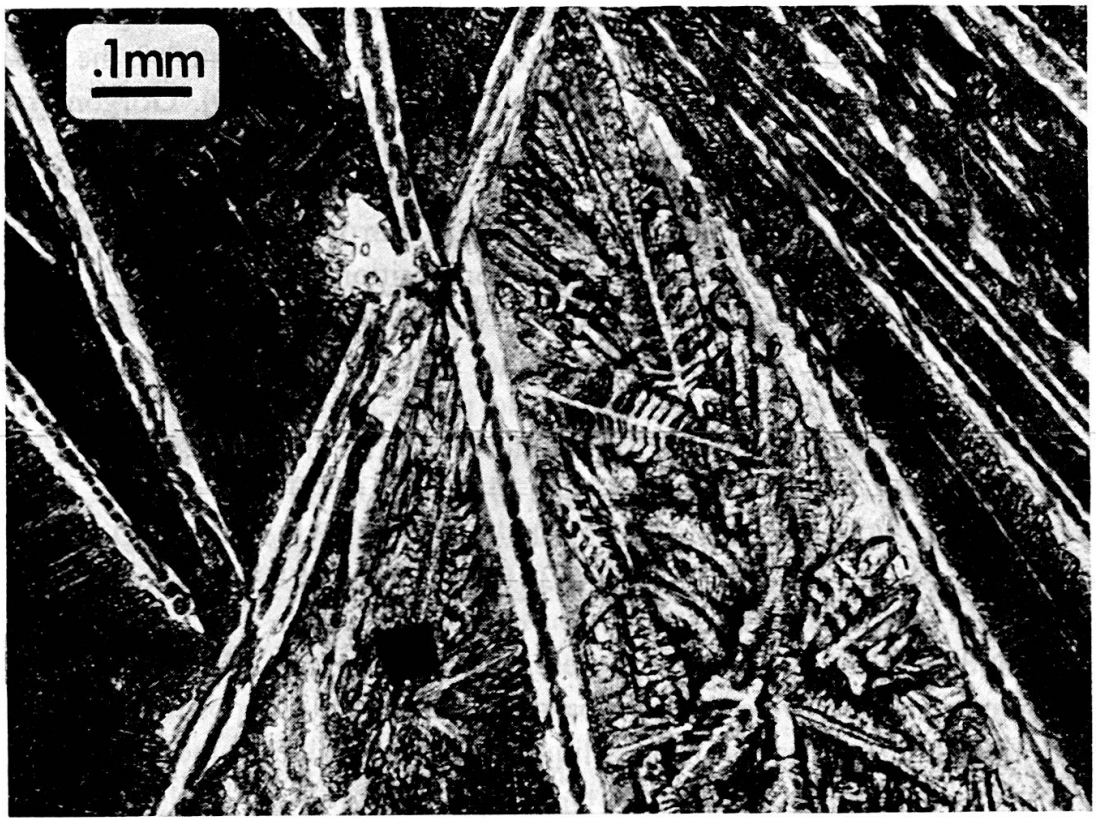

FIG. 1. — Spinifex-textured komatiite from Gorgona island. Sample from the outer most part of an ultramafic lava flow. The weakly serpentinized skeletal plates of olivine ($Fo_{90\text{-}91}$) cause a pronounced octahedral cleavage at the rock surface. The quenched groundmass consists of clinopyroxene aggregates together with euhedral and partly quenched chromian spinel (opaque mineral).

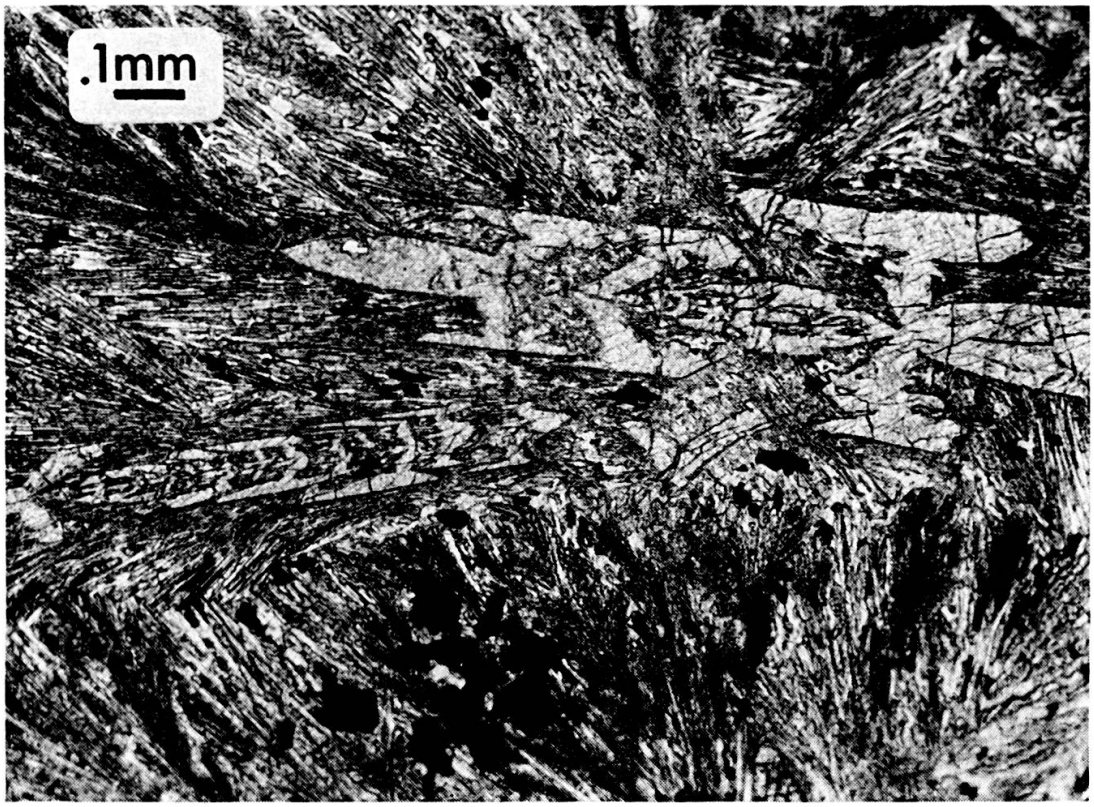

FIG. 2. — Photomicrograph of the inner part of a spinifextextured lava flow: two large skeletal high-aluminium (up to 13 *wt.*% Al_2O_3) calcic pyroxenes and euhedral to quenched chromian spinels in a groundmass of plagioclase laths ($Ln_{75\text{-}81}$), low-aluminium calcic pyroxenes and Ti-magnetite (small irregular opake phases). The large quenched olivine plates ($Fo_{90\text{-}91}$ with narrow edges of $Fo_{85\text{-}86}$) are not shown in this picture.

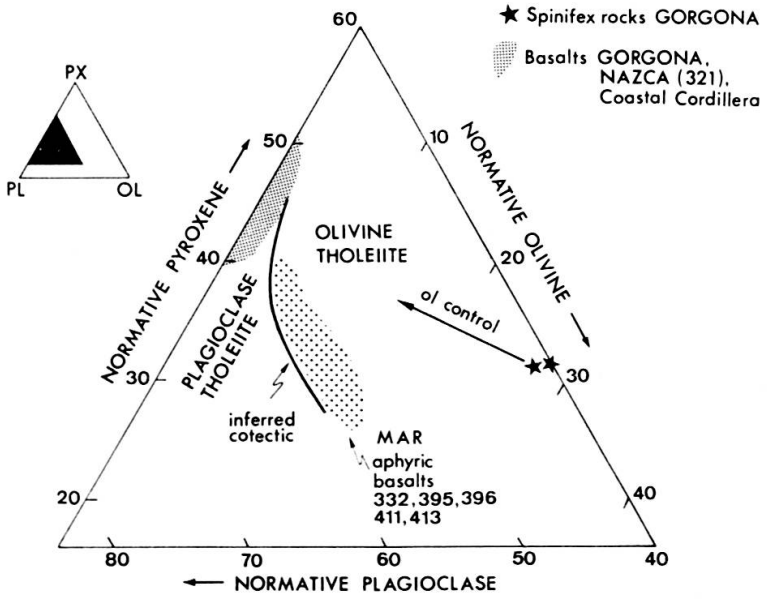

FIG. 3. — Normative olivine-plagioclase-pyroxene relationships between the Gorgona spinifex rocks and aphyric Mid-Atlantic-Ridge basalts (Leg 37, site 332, Blanchard et al. 1976; Legs 45 and 46, Sites 395 and 396, Dungan et al. 1978 and Rhodes et al. 1978; Leg 49, Sites 411 and 413, Wood et al. 1979) and Tertiary basalts from the Pacific (Nasca plate Leg 34, Site 321, Mazzullo and Bence 1976 and Rhodes et al. 1976; Coastal Cordillera, Goossens et al. 1977). The empirically determined olivine-plagioclase cotectic line is from Shido et al. (1971). The slope of the olivine control line has been calculated extracting 10% of forsterite from the Gorgona spinifex rocks.

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