

KOMATIITES AS SOURCES OF HIGH MAGNESIUM MICROTEKTITES

William N. Agosto, Lunar Industries, P.O. Box 590004, Houston, TX. 77259-0004

While there seems little doubt about the terrestrial origins of tektites, local provenance of the strewn-fields and their chemical subgroups is still a matter of debate. Source regions of the high Mg "bottle green" microtektites, which have anomalous pyroxenite-like compositions, are of particular interest. Several authors have proposed an igneous origin for these objects (1,2) and Frey (3) noted that their compositions can't be explained by simple fractionation of sedimentary rocks.

In support of an igneous parent, it is of interest to note that the Fe/Mn ratios of high Mg australasian tektites and microtektites as well as high Mg Ivory Coast microtektites fall into the field of terrestrial basalt and komatiite compositions plotted in Stolper et al. (4).

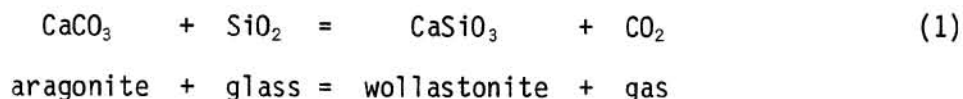
Because of their ultramafic compositions, komatiites are intriguing candidates for high Mg microtektite parents. In Table 1, column 1, I have listed a compositional average of 8 australasian and 4 Ivory Coast high Mg microtektites (5) and, in column 2, the compositional average of 29 komatiites from Australia, Colombia, Newfoundland and Rhodesia (6,7,8).

Table 1. High Mg Microtektite and Komatiite Compositions Compared (wt%)

	<u>1</u>	<u>2</u>	<u>3</u>
SiO ₂	55.1	49.7	50.2
TiO ₂	.67	.43	.61
Al ₂ O ₃	13.3	11.2	12.1
FeO	7.5	10.2	10.2
MnO	.1	.14	.14
MgO	17.9	17.2	16.3
CaO	4.1	9.1	9.1
Na ₂ O	.66	1.2	1.2
K ₂ O	.34	.2	.3

Legend: 1, avg. of 12 high Mg microtektites (5); 2, avg. of 29 komatiites (6,7,8); 3, 1 recalculated.

The chief differences in the compositional averages in columns 1 and 2 of Table 1 are the lower CaO, FeO and Na₂O contents of the microtektites compared with the komatiites. The FeO and Na₂O discrepancies can be explained by volatilization of these components during the high temperature impact events (> 2000°C) that generate tektites from target terrestrial sources. King (9) has demonstrated strong FeO and alkali depletion with concomitant SiO₂ and refractory enrichment in samples of Murchison and the Columbia Plateau basalts that were heated in a solar furnace to 2300 ± 100°C for tens of minutes. The lower refractory CaO component in microtektites compared with komatiites may result from the action of CO₂ ice in cometary bodies on wollastonite pyroxene components in the target according to the well known reaction:



Thermodynamically, reaction (1) proceeds to the left for CO₂ pressures in

excess of approximately 10.5 kbar at 1000K for unit activities of the components. The pressure level is consistent with hypervelocity impacts of CO₂ rich comet ice. Aragonite and silica glass have been chosen as likely products of reaction (1) in the high pressure-temperature impact regime. Since the reaction would occur at the gas-liquid interface of the reactants, aragonite could be expected to coat the product glass and dissolve at the ocean depths where microtektites are found. Excess silica would react with the olivine rich composition of the product glass leaving it free of lechatelierite as is observed in high Mg microtektites (5). Tektite generation by comet ice impact showers or the single ice fragment impact proposed for the Tunguska event, may explain the dearth of craters associated with the major strewn-fields.

In column 3 of Table 1, FeO, MnO (assumed to volatilize with FeO), CaO and Na₂O discrepancies between the high Mg microtektite and komatiite compositional averages have been added to the microtektite compositions and recalculated to 100% to give a presumed parent. SiO₂, Al₂O₃ and MgO contents in the recalculated composition are within 8% of the komatiite levels on a relative basis. The TiO₂ and Al₂O₃ differences between columns 2 and 3 may reflect tektite refractory enrichment, but K₂O should be lower in the microtektites than in the komatiites. That is not the case and may reflect the wide regional potassium variation in komatiites and their alteration products.

Cr and Ni contents of high Mg microtektites up to 2000 and 300 ppm respectively are also consistent with a komatiitic origin. However, LREE enrichment in tektites and microtektites is not. More complete REE data for high Mg microtektites may resolve their apparent mismatch with the flat or depleted LREE patterns of komatiites.

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