THE $\delta^{18}O$ OF THE SANIDINE SPHERULES AT THE CRETACEOUS-TERTIARY BOUNDARY.

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$\delta^{18}O$ analyses were made on a sample of sanidine spherules from the basal lamina of the Cretaceous-Tertiary boundary clay of Caravaca, Spain. According to Smit and Klaver (1) this sanidine has structural characteristics typical of high temperature sanidine. They postulate that these spherules solidified from a melt and were probably derived from an impacting body hitting the Earth at that time.

Our experimental procedure involved the acidification of lightly crushed spherules in a dilute HCl solution, rinsing the powder with distilled water, and drying the powder at 100°C. The powder was then fluorinated and the resulting O_2 converted to CO_2 for $\delta^{18}O$ analysis by the usual techniques.

We made a $\delta^{17}O$ determination using the CO_2 technique (2) because an anamolous $\delta^{17}O$ would characterize the spherules as a product of some unusual extraterrestrial event. The $\delta^{17}O$ was normal. Table 1 shows the $\delta^{18}O$ values of the Caravaca sanidine spherules as well as their possible terrestrial sources of oxygen either by direct assimilation or by isotopic exchange.

The sanidine oxygen is clearly not of terrestrial igneous origin, nor fused marine or non-marine sediments. Its $\delta^{18}O$ is unlike that of tektites whose origin is probably terrestrial. High temperature equilibration with ocean water, or atmospheric water would result in a much lower $\delta^{18}O$, closer to $\delta^{18}O = 0$. The only obvious terrestrial candidate for the sanidine oxygen is atmospheric oxygen. A silicate oxygen whose $\delta^{18}O = +27‰$ might be feasible if very high temperature oxygen isotopic equilibration between the sanidine spherules and atmospheric O_2 occurred prior to the solidification of the spherules.

This possibility was tested by heating powdered microcline in a platinum capsule open at one end, in the laboratory atmosphere. The $\delta^{18}O$ values of the hot molten feldspar increased by 0.6‰ after about nine hours of heating. This small increase in $\delta^{18}O$ does not support the possibility of rapid exchange between the spherules and atmospheric O_2 but then the spherules may have been heated to even higher temperatures or were condensed from hot vapor at much higher temperatures at conditions more suitable for rapid exchange.

If such exchange took place the $\delta^{18}O$ of the spherules would be similar to the $\delta^{18}O$ of Cretaceous atmospheric O_2. The $\delta^{18}O$ of atmospheric O_2 is related to the processes involving photosynthetic production of O_2, and its use in the metabolic processes.

The possibility of an extraterrestrial origin of the oxygen in the sanidine spherules does not find support in their $\delta^{18}O$ values. The $\delta^{18}O$ values of the stony meteorites are similar to terrestrial igneous rocks.

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SANIDINE SPHERULES

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Table 1

The oxygen isotopic composition of the Caravaca sanidine and the possible source materials for the oxygen in this sanidine.

Samples	Description of Samples	$\delta^{18}O$ (‰)
Sanidine spherules from the K-T boundary	crushed and acid treated	27.4 27.7
Sedimentary rocks (3)	marine clays:	
	montmorillinite	17.2
	illite	15.4
	chlorite	14.9
	kaolinite	24.9
	shales	14 to 19
	soils	3 to 21
Tektites (4)		8.9 to 11.8
Atmospheric O_2 (5)		24
Hydrosphere (5)	ocean	~0
	atmospheric water	-7 or lower
Microcline	untreated	6.8
Pala District CA	Heated in air to 1199°C for 15 min.	6.9
	Heated in air to 1584 for 8.7 hours	7.4

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