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DISTRIBUTION OF SOLAR WIND IMPLANTED NOBLE GASES IN LUNAR SAMPLES

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The distribution of solar wind implanted noble gases in lunar samples depends on implantation energy, fluence, diffusion, radiation damage and erosion. It is known that at least the lighter rare gases are fractionated after implantation, but the redistribution processes, which mainly drive the losses, are not well understood. Some information about this one can get by looking at the concentration profiles of solar wind implanted ^{4}He measured by the Gas Ion Probe (1) in single lunar grains (> 100 microns). The observed profiles have been divided in three groups (2). THESE GROUP ARE ILLUSTRATED AND BRIEFLY DISCUSSED.

I) Surface profiles, characterized by the position of maximum ^{4}He concentration within the direct implantation range (fiure 1).

II) Deep profiles, characterized by the position of maximum ^{4}He concentration below the direct implantation range and in comparison to type I a much broader gas distribution (figure 2).

III) Double humped profiles, characterized by two maxima, one at the very surface and a second one between 300 and 600 Å. This type of profile is mineral specific and up to now only found in olivines (figure 3).

The expected mean range of implanted solar wind He in lunar samples is typically 200 Å (3). However, near this value The maximum ^{4}He concentration is only found in some few ilmenites. All the other recorded profiles seem to be more or less changed by secondary processes mainly by diffusion under the special condition of severe radiation damage. Erosion by sputtering is believed to be a less important process in changing the ^{4}He implantation profile and is not taken into consideration.

In a simple model the evolution of a rare gas implantation profile under lunar conditions was described (4). According to this model it is shown on single ilmenite grains that the fractionation of the residual noble gases increases, when the position of maximum ^{4}He concentration is found nearer toward the surface. By using this correlation one can separate ilmenites with ^{4}He profiles corresponding to a low degree of fractionation. Such classes of ilmenites selected from different samples may be suitable to look for variation in composition and energy of present and past solar wind.

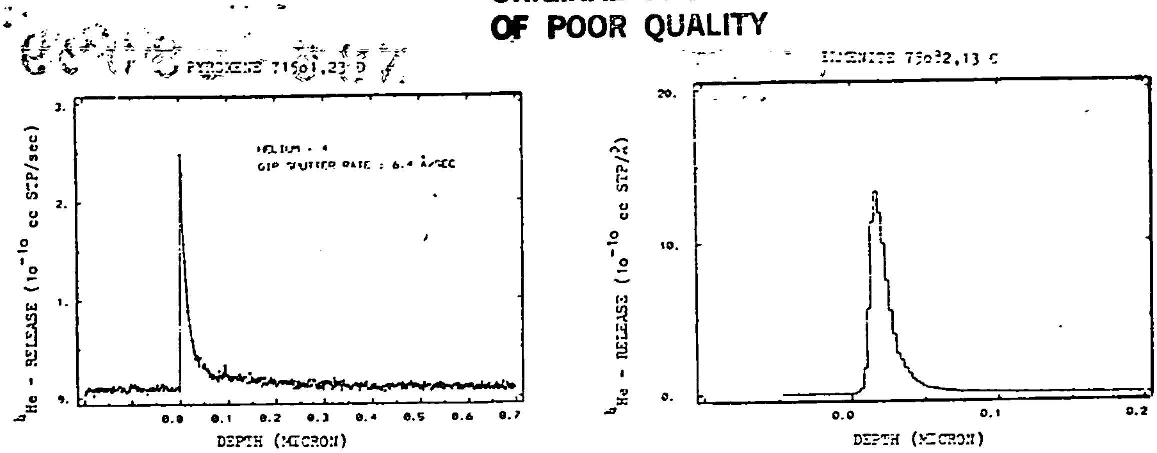

Fig. 1) Surface profiles with maximum ^{4}He concentration within the direct implantation range of the solar wind. The example on the left shows an He profile in a pyroxene with maximum concentration immediately at the surface, on the right in an ilmenite He has the highest concentration at 17o Å.

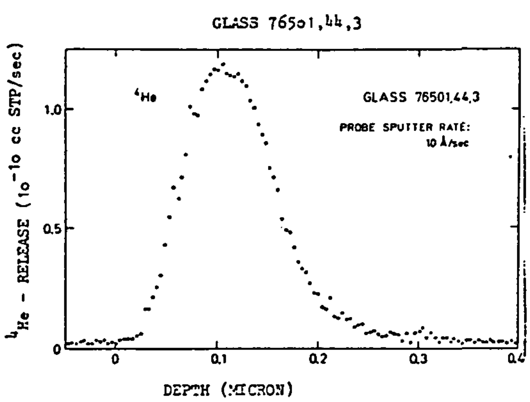

Fig. 2) Deep profile with maximum He concentration at a depth of 11oo Å.

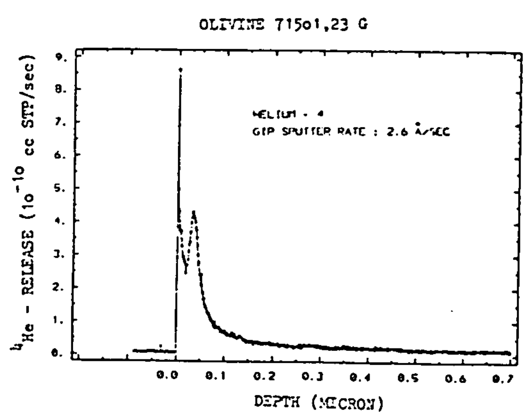

Fig. 3) Double humped profile with two He maxima one at the very surface and a second one at 32o Å.

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