KALAHARI 008/009 - THE SHORTEST EXPOSURE AGE OF ALL METEORITES. K. Nishiizumi[1], K. C. Welten[1], and A. Bischoff[2]. [1]Space Sciences Laboratory, University of California, Berkeley, CA 94720-7450, USA. kuni@ssl.berkeley.edu. [2]Institut für Planetologie, 48149 Münster, Germany.

Introduction: During geological field work in Botswana Kalahari 008 (598 g) and 009 (~13.5 kg) were found roughly 50 m apart in front of a small dune [1, 2]. Cosmogenic nuclide studies provide information on the exposure histories of those objects.

Sample Description: Kalahari 008 is an anorthositic breccia having typical clasts of lunar highland breccias. Olivine crystals are typically much less frequent than pyroxene and display a distinct bimodal distribution in composition. Pyroxenes show a wide range of compositions. Most plagioclases in clasts and matrix are anorthites [1, 2].

Compositionally and texturally, Kalahari 009 differs from Kalahari 008. Considering chemical composition and mineralogy Kalahari 009 is compatible with a VLT lunar mare basalt. It is a fragmental breccia consisting of fragments of basaltic lithologies embedded in a fine-grained matrix. Main constituents are pyroxene and plagioclase. Olivine occurs less frequently [1, 2].

Cosmogenic Radionuclides: Cosmogenic radionuclides in Kalahari 008 (130 mg) and 009 (157 mg) were measured by AMS at Lawrence Livermore National Lab and the results are shown in Table 1. The cosmogenic nuclide concentrations in Kalahari 008 and 009 are the lowest activities in stony meteorites ever measured. The ^{41}Ca concentrations in both samples were below detection limit. Cosmogenic radionuclide concentrations of Kalahari 008 are 40-70% higher than that of Kalahari 009 but nuclide ratios are very similar for both objects indicating different shielding conditions in the same object in space. The ^{26}Al/^{10}Be activity ratios of Kalahari 008 and 009 are both 1.0±0.3 that is lower than the production rate ratio of ~4. A large portion of the ^{10}Be might be meteoric ^{10}Be contamination, even though both samples were acid leached. The combined ^{26}Al and ^{36}Cl 4π exposure ages are 350±120 yr for Kalahari 008 and 220±40 yr for Kalahari 009 that is the shortest exposure age of any meteorite. If both objects are lunar meteorites, the transition time from the Moon to the earth was 230±90 yr and ejection depth was more than >1,100 g/cm^2 on the Moon. Small amounts of cosmogenic nuclides are also produced *in-situ* on the Earth's surface. The ^{26}Al and ^{36}Cl concentrations in Kalahari 009 can be explained by ~0.3 Myr exposure time in the Kalahari Desert (1,000 m elevation and 21˚S). Long terrestrial ages, 0.3-0.5 Myr, were found for Dhofar lunar and Martian meteorites [3]. For the case of Kalahari 009, cosmogenic nuclides could have been produced on the Earth's surface, without previous exposure in space. Cosmogenic nuclide results do not exclude that Kalahari 009 is a terrestrial object. However, the ^{36}Cl concentration in Kalahari 008 is ~15% higher than saturation of ^{36}Cl production on the Earth's surface, therefore Kalahari 008 was exposed in space.

Table 1. Cosmogenic radionuclide concentrations (dpm/kg) in Kalahari meteorites.

Kalahari	^{10}Be	^{26}Al	^{36}Cl	^{41}Ca
008	0.021±0.001	0.020±0.006	0.022±0.001	0.40±0.37
009	0.014±0.001	0.014±0.004	0.010±0.002	0.03±0.21

References: [1] Sokol A. K. and Bischoff A. (2005) *Meteorit. Planet. Sci.*, This volume. [2] Sokol A. K. and Bischoff A. (2005) *Meteorit. Planet. Sci.*, submitted. [3] Nishiizumi K., et al. (2002) *Lunar and Planetary Science*, XXXIII, CD-ROM, #1366 .