NANOSIMS: THE NEXT GENERATION ION PROBE FOR THE MICROANALYSIS OF EXTRATERRESTRIAL MATERIAL. F. J. Stadermann, R. M. Walker and E. Zinner, McDonnell Center for the Space Sciences and Physics Department, Washington University, St. Louis, Missouri 63130, USA (fjs@howdy.wustl.edu).

Secondary ion mass spectrometry (SIMS) is the method of choice for isotopic measurements at high spatial resolution. It is used to study a wide array of geological samples and in recent years has led to the creation of an entirely new scientific field: the laboratory study of individual grains of stardust [1]. So far these studies have been limited to particles larger than 1 μm, whereas smaller grains actually constitute most of the mass of presolar material found in meteorites (as well as in dust populations observed astronomically). Clearly, a new type of ion probe is needed for precise isotopic characterization of sub-micron phases.

This next generation ion probe is represented by the NanoSIMS, the first of which will soon be installed at Washington University. We have previously reported the results of several tests on this new instrument that verify its suitability for the analysis of extremely small phases [2]. The instrument will also be uniquely suited for studies of IDPs and comet dust returned by STARDUST. Furthermore, the high spatial resolution can bring a new level of detail to studies of zoning and grain boundary structures in igneous samples.

The basic schematic of the NanoSIMS, designed by G. Slodzian, is shown in Figure 1. The instrument has been specially designed to optimize both sensitivity and selectivity [3]. It has evolved over several years and various prototypes [3-9] to the NanoSIMS of today, which is now commercially available from CAMECA. Its unique design, with a normal incidence primary beam and a small working distance of the immersion lens, results in a smaller primary beam spot and high secondary ion collection efficiency. The prototype has achieved primary ion beam diameters as small as 30 nm [3] and significantly higher secondary ion yields than the ims3f and even the ims1270 at mass resolutions up to 6000 [2]. In tests to measure the oxygen isotopic compositions of 300 nm standard particles, the NanoSIMS performed within limits imposed only by counting statistics, indicating that this type of measurement can be extended to particles that are even smaller [2].

In the NanoSIMS, a mass spectrum is displayed along the focal plane of the magnet, where moveable detectors can be adjusted for the parallel measurement of up to 6 masses. In fact, the NanoSIMS is the only instrument that will allow the simultaneous high precision measurement of $^{13}\text{C}/^{12}\text{C}$, $^{29}\text{Si}/^{28}\text{Si}$ and $^{30}\text{Si}/^{28}\text{Si}$ isotopic ratios at high lateral resolution.