LOW-Ni "COSMIC" PARTICLES IN THE STRATOSPHERIC DUST COLLECTION: AN EXAMINATION OF THE JSC CATALOG EDX SPECTRA. E. Cooke[1], G. J. Flynn[1], and S. R. Sutton[2] (1) Dept. of Physics, SUNY-Plattsburgh, Plattsburgh, NY 12901, (2) Dept. of Geophysical Science, The University of Chicago, Chicago, IL 60637.

INTRODUCTION: Flynn and Sutton (1,2) have identified three stratospheric dust particles exhibiting "igneous" minor/trace element abundance patterns but which were provisionally classified as cosmic (C-type) or possibly cosmic (C?-type) on the basis of the similarity of their major element abundances to chondritic material. Zolensky et al. (3) have identified a fourth such particle. Of the 18 "cosmic" particles analyzed for trace elements by Flynn and Sutton (1, 2), three (or 17%) exhibited these igneous minor/trace element abundance patterns, and the same fraction, one of six analyzed, was found by Zolensky et al. (3). If such a large fraction of the stratospheric "cosmic" particles were found to be of the igneous type, it would indicate the need for a refinement of the preliminary classification system so that investigators could select either normal chondritic particles or the igneous ones for their analyses. However, the fraction of igneous particles reported in the trace element studies cannot be taken as indicative of their true fraction in the stratospheric collections since the particles selected for trace element analysis may not be an unbiased sample.

EXPERIMENTAL METHOD: To place limits on the fraction of igneous particles in the stratospheric collection we have examined the Johnson Space Center (JSC) Energy Dispersive X-Ray (EDX) spectra of all C-type and C?-type particles cataloged by JSC since the inception of the JSC cosmic dust collection program. As discussed by Flynn and Sutton (2), one element, Ni, detectable in many chondritic particles by routine EDX analysis provides a way of distinguishing normal chondritic particles from those which may be igneous. Using Synchrotron X-Ray Fluoresence (SXRF) we can accurately determine the Ni content. The chondritic particles generally exhibit Fe/Ni ratios within a factor of 3 of the chondritic ratio of 17 (2). The three igneous particles exhibited dramatically different Fe/Ni ratios of 240, 330, and 960 (2).

Examination of the JSC catalog spectra is complicated by the fact that Ni is too low to be detected under the EDX analysis conditions employed for the JSC catalog spectra for particles having non-chondritic Fe/Ni ratios (>100), particles with low Fe abundances, and normal chondritic particles which are small enough that the Ni peak is indistinguishable from the noise. Examination of the Allende powder EDX spectra in the JSC Cosmic Dust Catalogs indicates that under the JSC analysis conditions:

1) the Fe K-α to Ni K-α peak height ratio is approximately equal to the Fe to Ni element abundance ratio, and,

2) in chondritic particles, the Fe K-β peak height is typically 1 to 3 times the Ni K-α peak height.

Thus we call a particle low-Ni if either the Fe/Ni ratio is > 50 (3x chondritic), or if the Fe K-β peak is easily detectable but the Ni K-α peak is absent. No meaningful Fe/Ni ratio can be determined for particles with no detectable Fe K-β peak in the JSC

catalog spectra, because the Ni peak would not be seen even at a chondritic Fe/Ni ratio. Thus we exclude these particles from our examination.

RESULTS: For each of the catalogs we have determined the number of particles preliminarily classified as C-type or C?-type having an easily detectable Fe K-β peak, and the number of those which are low-Ni:

Catalog	# C-type w/Fe K-β	# low-Ni C-type	Fract	# C?-type w/Fe K-β	# low-Ni C?-type	Fract
V 1, N 1	12	2	17%	0	0	---
V 1, N 2	0	0	---	17	5	29%
V 2, N 1	22	3	13%	9	3	33%
V 2, N 2	13	4	30%	10	5	50%
V 3, N 1	14	0	0%	11	7	64%
V 4, N 1	22	3	14%	7	3	43%
V 4, N 2	14	6	43%	4	3	75%
V 5, N 1	39	4	10%	8	2	25%
V 6, N 1	23	2	8%	1	1	100%
V 7, N 1	33	7	21%	3	1	33%
V 8, N 1	34	3	11%	10	4	40%
V 9, N 1	13	3	23%	0	0	---
V 10, N 1	17	1	6%	2	1	50%
V 11, N 1	81	8	10%	30	8	27%
CD Cou. 5	7	0	0%	4	1	25%
TOTAL	344	46	13%	116	44	38%

CONCLUSIONS: The fraction of low-Ni particles varies significantly from collector to collector, but there are no obvious trends with time. The low-Ni particles have been a persistent and significant component of the stratospheric collections from the earliest to the most recent catalogs. A large fraction (13%) of the stratospheric particles provisionally classified as C-type in the JSC Cosmic Dust Catalogs exhibit Fe/Ni ratios significantly greater than chondritic. Though the minor/trace element composition of these low-Ni particles is unknown, they are candidates for the igneous particle type identified by Flynn and Sutton (1). The origin of the igneous particles has not yet been established (2). They may be terrestrial or extraterrestrial samples from a differentiated parent body (such as the moon or the achondrite parents).

Investigators wishing to examine chondritic particles should exercise caution to establish the composition of particles selected for investigation, and, as suggested in the JSC Catalogs, should use the provisional classifications only as a guide (4).

REFERENCES: 1. Flynn, G. J. and Sutton, S. R. (1990), Proc. 20th Lunar & Planet. Sci. Conf., pp. 335-352. 2. Flynn, G. J. and Sutton, S. R. (1991), "Chemical Charactarization of Seven Large Area Collector Particles by SXRF," Proc. 21st Lunar & Planet. Sci. Conf. (in press). 3. Zolensky, M. E., Lindstrom, D. J., Thomas, K. L., Lindstrom, R. M., and Lindstrom, M. M. (1989), Lunar & Planet. Sci. XX, pp. 1255-56. 4. Zolensky, M. E. et al. (1989), Cosmic Dust Catalog, Vol. 10, No. 1, NASA Johnson Space Center, Planetary Materials Branch Pub. No. 80, p. ix.