THE PRESOLAR GRAIN DATABASE: http://presolar.wustl.edu/~pgd. K.M. Hynes and F. Gyngard, Laboratory for Space Sciences and Department of Physics, Washington University, St. Louis, MO 63130, USA, kmhynes@wustl.edu.

Introduction: Presolar grains were first discovered in meteorites in 1987. Presolar diamond [1] and SiC [2] were the first grain types to be identified by their anomalous isotopic compositions, followed by graphite [3], oxides [4-6], Si_3N_4 [7], and silicates [8]. Since this time, the isotopic composition of thousands of grains has been measured. Several isotopes are usually measured in each grain, resulting in tens of thousands of isotopic ratios for presolar grains, which have been reported in hundreds of papers. With such a large amount of isotopic data, it can be difficult to locate all of the grains that have been measured for a particular isotope of interest, much less all the grains of a particular type. Although a few personal data compilations exist , there is no comprehensive, easily accessible database available to the astrophysical community. Here we present details about a website containing a collection of the vast majority of isotopic data on presolar grains. The data are presented to the entire community for download at http://presolar.wustl.edu/~pgd.

Methods: For every presolar grain paper, relevant information was put into a spreadsheet. Isotopic data for each grain were normalized to the isotopic ratios most commonly used in the literature (for example, data reported as ^{29}Si/^{28}Si were converted to δ^{29}Si/δ^{28}Si). All errors were then recalculated to reflect these isotopic ratios and adjusted to be 1σ (Fig. 1). In addition to isotopic data, other important information was included for each grain: grain type (e.g., SiC); subtype (e.g., SiC mainstream, AB, X, Y, or Z grain, as defined by [9]); grain label; meteorite of origin; measurement technique and location (e.g., Washington University NanoSIMS); grain size in microns, if available; and the journal reference (Fig. 2).

^{12}C/^{13}C	Error[^{12}C/^{13}C]	d(^{29}Si/^{28}Si)	Error[d(^{29}Si/^{28}Si)]	d(^{30}Si/^{28}Si)	Error[d(^{30}Si/^{28}Si)]
47.5	0.4	45	4	73	7
55.7	0.4	70	4	75	7
48	0.4	51	4	74	7
47.4	0.4	36	4	57	7
47.5	0.4	57	4	71	7
48	0.4	55	4	65	7
47.9	0.4	57	4	66	7
90.8	0.7	15	3	21	7
47.4	0.4	54	4	76	7

Figure 1. Example of a spreadsheet of isotopic ratios and the corresponding errors of SiC mainstream grains.

The data are available for download in several forms. First, the data are separated by individual papers. Second, all the data are sorted according to subtype, so that the user can download one spreadsheet of all the available data for a single subtype of grain, such as SiC X grains only or high density graphite grains only. Finally, all the data for each grain type are put into a single file, so that, for example, all SiC isotopic data are collected into a single file for downloading. Additionally, each data set is available as both an Excel file and a tab-delimited text file for maximum compatibility (Fig. 3).

For security purposes, data can only be downloaded from the website; nothing can be uploaded onto the website. Communication occurs via email to pgd@physics.wustl.edu, which is also listed on the website. Both the website itself and the email account are hosted by Washington University. As an additional measure of security, the website is password protected; all password requests can be emailed to pgd@physics.wustl.edu.

Type	Grain Label	Reference	Meteorite	Technique	Size (mm)
M	a3-3	Gyngard ApJ 2009	Murchison	Wash U NanoSIMS	37
M	a4-2	Gyngard ApJ 2009	Murchison	Wash U NanoSIMS	8
M	a4-4	Gyngard ApJ 2009	Murchison	Wash U NanoSIMS	23
M	a4-5	Gyngard ApJ 2009	Murchison	Wash U NanoSIMS	43
M	a5-1	Gyngard ApJ 2009	Murchison	Wash U NanoSIMS	5
M	b3-2	Gyngard ApJ 2009	Murchison	Wash U NanoSIMS	18
M	d3-1	Gyngard ApJ 2009	Murchison	Wash U NanoSIMS	20
M	d3-4	Gyngard ApJ 2009	Murchison	Wash U NanoSIMS	8
M	b5-1	Gyngard ApJ 2009	Murchison	Wash U NanoSIMS	5

Figure 2. Example of a spreadsheet containing additional information about each SiC grain listed in Figure 1.

Discussion: The database is intended as a tool for the entire presolar grain and cosmochemistry community, as well as scientists in other fields. The most useful feature of the database is the ease of locating and plotting data for any grain type or isotope of interest. It is also extremely useful as a quick-reference library for presolar grain research. For experimentalists, this is quite helpful for comparing new data to existing work, as well as aiding in making conclusions about a dataset. The reference list also assists in easily locating all previous work on a certain grain type or an isotopic system of interest. For theoreticians, a complete list of data is essential for comparing nucleosynthesis calculations to experimentally measured values. The isotopic data could also prove very useful to nuclear physicists and astronomers, as well as to students or new-comers to the field, who might also find the references helpful in trying to familiarize themselves with presolar grain research. The database can be accessed directly or through a link provided on the Washington University Presolar Grain Group's website (http://presolar.wustl.edu) or as the first entry under "presolar database" on Google. A link is also provided on the "presolar grains" Wikipedia page. Everyone is welcome to use the database to provide data for papers, abstracts, and talks. The database can be referenced either by this abstract or in an acknowledgements section.

Although the database is a powerful tool for locating and utilizing isotopic data on presolar grains, there are limitations. The website is simple to navigate, but there is no independent search feature. If the user is interested in a subset of data other than those discussed above, such as all Ti data, they must first download the complete file of grain data and then sort it on their own computer with Microsoft Excel or another similar program of the user's choosing. Errors are also problematic in some cases, since they can be calculated in different ways by different people. The errors found in the database are copied directly from the paper in which they are given, with the only changes being to put them in a more standard form. Measurements that have no error associated with them are excluded, as are measurements with errors that are a significant fraction of the reported value. In both cases, the measurement is omitted because it lacks statistical significance and could affect overall trends of a dataset. For a small number of grains, the errors are not symmetrical. In these cases, only the larger error is recorded in the database for convenience and ease of plotting, since many graphing programs cannot easily handle asymmetric errors. Correlated errors are also not addressed and the user is referred back to the original paper if such information is required. The database is intended as a simple, online library of all presolar grain data, presented in the most commonly used formats. For any user who requires more complicated or uncommon calculations, the database can serve as a starting point to assemble the relevant data and the reference list should be of assistance in locating the works from which these data come.

In order to improve the database, community involvement is crucial. Feedback on issues such as possible improvements, new features that could be added, any problems that are encountered, and especially new data that could be added to make the collection more complete, would benefit everyone using the database.

Figure 3. Sample image of the webpage used to download all SiC data. At the top, the user can navigate to other grain types and isotopic data listed by paper, as well as find contact information. At the bottom of the webpage, the user can navigate to each subtype of SiC grains.

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References: [1] Lewis R.S. et al. (1987) *Nature* 326, 160. [2] Bernatowicz T. et al. (1987) *Nature* 330, 728. [3] Amari S. et al. (1990) *Nature* 345, 238. [4] Huss G.R. et al. (1993) *Meteoritics* 28, 369. [5] Hutcheon I.D. et al. (1994) *ApJ.* 425, L97. [6] Nittler L.R. et al. (1994) *Nature* 370, 443. [7] Nittler L.R. et al. (1995) *ApJ.* 453, L25. [8] Nguyen A.N. and Zinner E. (2004) *Science* 303, 1496. [9] Hoppe P. et al. (1994) *ApJ.* 430, 870.