THE PRESOLAR GRAIN DATABASE RELOADED—GRAPHITE.

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Introduction: Since their first isolation from meteorites some 35 years ago, tens of thousands of individual presolar grains have been analyzed for their isotopic composition, many of them in an automated way to search for rare and exotic grains. In 2009, the Presolr Grain Database (PGD), a collection of spreadsheets containing isotope data on presolar grains, was released [1]. In 2019, after it had become apparent that parts of the PGD had become compromised by accumulating errors over the years, we decided to rebuild the PGD from the ground up by: (1) eliminating known errors; (2) searching for inconsistencies by comparing with publications, original data files, and/or personal compilations; and (3) updating and adding data that have been reevaluated and/or published [2]. The initial effort focused on silicon carbide (SiC), for which an established new version of the PGD now exists, containing data for, as of this writing, 20,230 individual presolar SiC grains [3,4]. All versions for SiC since the restart of the PGD in 2019 can be found at https://zenodo.org/doi/10.5281/zenodo.8187219. Based on the new PGD, updated rules for SiC grain type classification were developed to unify previous efforts, taking into account new SiC grain types that have been proposed over the last three and a half decades [4].

We recently shifted our focus to presolar graphite in order to rebuild the PGD also for this kind of presolar grain from the ground up.

The new Presolar Grain Database for graphite: While the old PGD showed 2216 entries for graphite grains attributed to five different publications, rebuilding the database from scratch revealed that 118 grains had double entries in the old database, typically due to inconsistent labeling. Some grain data, although provided in these publications, were missing from the old database, while other data could not be attributed to any grains mentioned in these or in other publications and were therefore removed. Some obviously incorrectly reported data were found, either in the old PGD or in some of the publications. Some preliminary data had been reported in the old PGD or early publications but have been reevaluated later, leading to small changes in values of isotope data. Some grain data had been published prior to the five papers mentioned in the old PGD. The new PGD for graphite now associates each grain data entry to the first publication we were able to find that contains at least some of its isotope data. With six more recent publications, the data of which has also been added, the PGD for graphite now contains data for 2122 individual graphite grains attributed to 18 different publications.

The first version of the PGD for graphite grains as well as all future versions can be found at https://zenodo.org/doi/10.5281/zenodo.11188115. As with the PGD for SiC, each grain has been given a unique PGD ID, which is not meant to replace a grain label defined in the original publication, but to prevent confusion from inconsistent nomenclatures used. Grains have been divided into two types, low-density and high-density grains, using 2.1 g/cm³ as a divider. In addition, lower and upper limits of the density range of the grain separate are provided as well as information about grain morphology if available.

Discussion and Outlook: As for SiC, we will continue our work on the PGD for graphite in the upcoming years. So far, we have mainly rebuilt the old database by correcting inconsistencies. Major tasks will be to add more data from publications not covered by the old database. After adding such data to the PGD for graphite, we will shift our focus to other kinds of presolar grains, including oxides, silicates, and rarer phases. Furthermore, we are working on making a first version of Python tools (PGDTools) available later this year, which will allow the user to programmatically interact with current and future databases.

We strongly encourage users of the PGD to give proper credit to the authors of the original papers by also referencing those publications.