



HAL
open science

The Meteoritical Bulletin, No. 110

Jérôme Gattacceca, Francis M. McCubbin, Jeffrey Grossman, Audrey Bouvier,
Nancy L. Chabot, Massimo d'Orazio, Cyrena Goodrich, Ansgar Greshake,
Juliane Gross, Mutsumi Komatsu, et al.

► **To cite this version:**

Jérôme Gattacceca, Francis M. McCubbin, Jeffrey Grossman, Audrey Bouvier, Nancy L. Chabot, et al.. The Meteoritical Bulletin, No. 110. Meteoritics and Planetary Science, 2022, 57, pp.2102-2105. 10.1111/maps.13918 . insu-03863070

HAL Id: insu-03863070

<https://insu.hal.science/insu-03863070>

Submitted on 21 Nov 2022







HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

The Meteoritical Bulletin, No. 110

Jérôme GATTACCECA ^{1*}, Francis M. McCUBBIN², Jeffrey GROSSMAN³, Audrey BOUVIER⁴, Nancy L. CHABOT ⁵, Massimo D'ORAZIO⁶, Cyrena GOODRICH ⁷, Ansgar GRESHAKE⁸, Juliane GROSS^{2,9}, Mutsumi KOMATSU ¹⁰, Bingkui MIAO ¹¹, and Devin SCHRADER ¹²

¹CNRS, Aix Marseille Univ, IRD, INRAE, CEREGE, Aix-en-Provence 13545, France

²NASA Johnson Space Center, Mail Code XI, 2101 NASA Parkway, Houston, Texas 77058, USA

³Reston, Virginia 20194, USA

⁴Bayerisches Geoinstitut, Universität Bayreuth, 95447 Bayreuth, Germany

⁵Applied Physics Laboratory, Johns Hopkins University, Laurel, Maryland 20723, USA

⁶Dipartimento di Scienze della Terra, Università di Pisa, Pisa 56126, Italy

⁷Lunar and Planetary Institute, USRA-Houston, 3600 Bay Area Blvd, Houston, Texas 77058, USA

⁸Leibniz-Institut für Biodiversitätsforschung, Museum für Naturkunde, Invalidenstraße 43, 10115 Berlin, Germany

⁹Department of Earth and Planetary Sciences, Rutgers University, Piscataway, New Jersey 08854, USA

¹⁰Saitama Prefectural University, Saitama 343-8540, Japan

¹¹Guilin University of Technology, Guangxi Province 541004, China

¹²Buseck Center for Meteorite Studies, School of Earth and Space Exploration, Arizona State University, 781 East Terrace Road, Tempe, Arizona 85287, USA

*Corresponding author. E-mail: gattacceca@cerege.fr

(Received 12 September 2022; revision accepted 20 September 2022)

Abstract—Meteoritical Bulletin 110 contains the 2802 meteorites approved by the Nomenclature Committee of the Meteoritical Society in 2021. It includes 10 falls (Arpu Kuilpu, Djadjarm, Glendale, Kindberg, Madura Cave, Motopi Pan, Orconuma, Punggur, Tihigrin, Winchcombe), with 2014 ordinary chondrites (including 1 ungrouped ordinary chondrite), 220 carbonaceous chondrites (including 11 ungrouped), 212 HED achondrites, 69 lunar meteorites, 62 ureilites, 43 iron meteorites, 35 Martian meteorites, 31 Rumuruti chondrites, 27 primitive achondrites, 24 mesosiderites, 19 relict meteorites (all iron meteorites), 15 pallasites, 13 enstatite chondrites, 11 ungrouped achondrites, 7 enstatite achondrites. Of the meteorites classified in 2021, 1270 are from Antarctica, 1049 from Africa, 329 from South America, 123 from Asia, 20 from North America, 6 from Europe, 3 from Oceania, and 2 from unknown locations.

TRENDS AND SPECIFICITIES

Meteoritical Bulletin 110 (MB110) contains the 2802 meteorites submitted to and accepted by the Nomenclature Committee of the Meteoritical Society in 2021. This is the highest number of new meteorites since the Meteoritical Bulletin has been phased with calendar years starting with Bulletin 105 in 2016. This high number is driven by the large numbers of Antarctic meteorites, and a record high number of meteorites classified as Northwest Africa (NWA) meteorites (930 meteorites). The 28 meteorites in MB110 total 18.9 tons of material, most of which is from the El Ali iron meteorite (15.2 t). Five other meteorites are over 100 kg (including NWA 13758 R3 chondrite), and 10

meteorites are between 50 and 100 kg (including Dhofar 2115 ureilite and NWA 13670 EL6).

In detail, 1270 meteorites are from Antarctica, 1049 from Africa (930 with an NWA name), 329 from South America (326 from Chile), 123 from Asia, 20 from North America (19 from the USA), 6 from Europe, 3 from Oceania, and 2 from unknown locations (Fig. 1). As for the last few years, Chile, with 326 meteorites (12% of the total), is now the main source of meteorites outside of North Africa and Antarctica.

The meteorites classified in MB110 include 10 falls that occurred between 2018 and 2021 with the addition of Orconuma that is from 2011. It is noteworthy that 5 of these 10 falls' meteorites were recovered with the assistance of camera networks such as the Desert Fireball

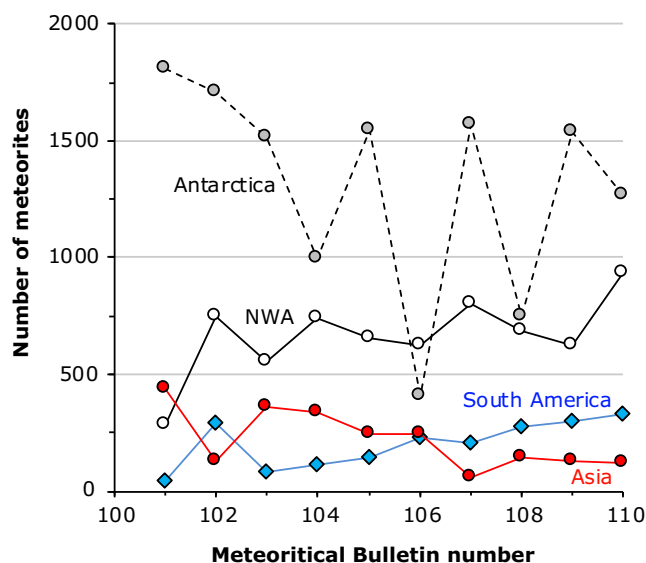


Fig. 1. Number of meteorites from Antarctica, northwest Africa (NWA), South America, and Asia reported in the last 10 Meteoritical Bulletins. (Color figure can be viewed at wileyonlinelibrary.com.)

Network in Australia (Bland et al., 2012), or international networks such as FRIPON (Colas et al., 2020).

The meteorites listed in MB110 comprise 2014 ordinary chondrites (including one ungrouped ordinary chondrite), 220 carbonaceous chondrites (including 66 CM, 55 CV, 42 CK among which 9 CK3, 35 CO, 9 CR, and 11 ungrouped carbonaceous chondrites), 212 HED achondrites, 62 ureilites, 69 lunar meteorites (a record high), 43 iron meteorites, 35 Martian meteorites (including 5 nakhlites), 31 Rumuruti chondrites, 27 primitive achondrites, 24 mesosiderites, 15 pallasites, 13 enstatite chondrites, 11 ungrouped achondrites, 7 aubrites.

Compared to previous years, the number of ungrouped chondrites (12) and ungrouped achondrites (11) has increased significantly. The ungrouped chondrites include mostly chondrites that are on the border between type 2 and type 3, and that have oxygen isotopic composition distinct from CM2 (for instance Telakoast 001; see Irving et al., 2022).

The following references were used to support the classification of meteorites in MB110: Barrat et al. (2016), Bischoff (2000), Bischoff et al. (2014), Gattacceca et al. (2020), Giguere et al. (2000), Goodrich and Keil (2002), Greenwood et al. (2017), Grossman and Brearley (2005), Huss et al. (2006), Jenniskens et al. (2021), Lunning et al. (2018), Metzler (2018), Metzler et al. (2021), Miller (2002), Newton et al. (2000), Rochette et al. (2003), Scott and Jones (1990), Sears et al. (1991), Shearer et al. (2008), Stoeffler et al. (1980), Torrano et al. (2020), Warren (1993), Wasson and Choi (2003), Wasson and Kallemeyn (2002),

Wasson and Richardson (2001), Wasson et al. (2007), and Weyrauch et al. (2017).

NOTABLE METEORITES

Winchcombe (CM2) is the latest of a series of five CM falls since 2017. Another notable fall is the Motopi Pan howardite. Meteorite finds that are notable for their mass, rarity, and/or scientific interest include El Ali (15.2 t iron belonging to the IAB complex), Erg Atouila 001 (a 793 g ungrouped achondrite with a modal abundance of ~95% albitic alkali feldspar, making it the first meteoritic albitite), Chug Chug 086 (only the 11th ungrouped ordinary chondrite), NWA 13758 (100 kg R3), NWA 14505 (24 kg CV3). Five new nakhlites have been registered in MB110, a very significant addition in view of the total numbers of known nakhlites (28 without considering pairing). The Nomenclature Committee now recognizes the CL carbonaceous chondrite group following the publication of Metzler et al. (2021). Five meteorites have been reclassified as CL in MB110: Coolidge, Loongana 001, Los Vientos 051, NWA 033, and NWA 13400. The large number of type 2/3 ungrouped carbonaceous in MB110 call for more work that may eventually lead to the definition of additional carbonaceous chondrite groups in peer-reviewed literature.

ALPHABETICAL TEXT ENTRIES FOR NON-ANTARCTIC METEORITES

See online version of this article.

NEW DENSE COLLECTION AREAS

In 2020, 38 new dense collection areas (DCA) were created, including 26 in the northwest Africa area: 11 in Algeria, 11 in Morocco and Western Sahara, 3 in Mali, 1 in Mauritania, 4 in China, 4 in Iran, 2 in the United Arab Emirates, 1 in Turkey, and 1 in Libya. A full list of all approved DCAs, with maps, can be found at <https://www.lpi.usra.edu/meteor/DenseAreas.php>.

LISTING OF INSTITUTES AND COLLECTIONS

An up-to-date index of collections and approved repositories (next to a green check mark) cited in the Meteorite Bulletin can be found here:

<https://www.lpi.usra.edu/meteor/MetBullAddresses.php?grp=country>

Data Availability Statement—The data that support the findings of this study are available in the supplementary material of this article.

REFERENCES

- Barrat, J.-A., Greenwood, R. C., Keil, K., Rouget, M. L., Boesenberg, J. S., Zanda, B., and Franchi, I. A. 2016. The Origin of Aubrites: Evidence from Lithophile Trace Element Abundances and Oxygen Isotope Compositions. *Geochimica et Cosmochimica Acta* 192: 29–48.
- Bischoff, A. 2000. Mineralogical Characterization of Primitive, Type-3 Lithologies in Rumuruti Chondrites. *Meteoritics & Planetary Science* 35: 699–706.
- Bischoff, A., Horstmann, M., Barrat, J.-A., Chaussidon, M., Pack, A., Herwartz, D., Ward, D., Vollmer, C., and Decker, S. 2014. Trachyandesitic Volcanism in the Early Solar System. *Proceedings of the National Academy of Sciences* 111: 12689–92.
- Bland, P. A., Spurny, P., Bevan, A. W. R., Howard, K. T., Towner, M. C., Benedix, G. K., Greenwood, R. C., et al. 2012. The Australian Desert Fireball Network: A New Era for Planetary Science. *Australian Journal of Earth Sciences* 59: 177–87.
- Colas, F., Zanda, B., Bouley, S., Jeanne, S., Malgoyre, A., Birlan, M., Blanpain, C., et al. 2020. FRIPON: A Worldwide Network to Track Incoming Meteoroids. *Astronomy & Astrophysics* 644: A53.
- Gattacceca, J., Bonal, L., Sonzognia, C., and Longereya, J. 2020. CV Chondrites: More than One Parent Body. *Earth and Planetary Science Letters* 547: 116467.
- Giguere, T. A., Taylor, G. J., Hawke, B. R., and Lucey, P. G. 2000. The Titanium Contents of Lunar Mare Basalts. *Meteoritics & Planetary Science* 35: 193–200.
- Goodrich, C. A., and Keil, K. 2002. Feldspathic and Other Unusual Clasts in Polymict Ureilite DaG 165 (Abstract #1777). 33rd Lunar and Planetary Science Conference. CD-ROM.
- Greenwood, R. C., Burbine, T. H., Miller, M. F., and Franchi, I. A. 2017. Melting and Differentiation of Early-Formed Asteroids: The Perspective from High Precision Oxygen Isotope Studies. *Geochemistry* 77: 1–43.
- Grossman, J. N., and Brearley, A. J. 2005. The Onset of Metamorphism in Ordinary and Carbonaceous Chondrites. *Meteoritics & Planetary Science* 40: 87–122.
- Huss, G. R., Rubin, A. E., and Grossman, J. N. 2006. Thermal Metamorphism in Chondrites. In *Meteorites and the Early Solar System II*, edited by D. S. Lauretta and H. Y. McSween Jr., vol. 943, 567–86. Tucson, Arizona: University of Arizona Press.
- Irving, A. J., Gattacceca, J., Ziegler, K., Sonzogni, C., Carpenter, P. K., and Garvie, L. A. J. 2022. CT Chondrites: A Newly Recognized Carbonaceous Chondrite Group with Multiple Members, Including Telakoast 001, Chwichiya 002 and Cimarron (Abstract #2046). 53rd Lunar and Planetary Science Conference. CD-ROM.
- Jenniskens, P., Gabadirwe, M., Yin, Q., Proyer, A., Moses, O., Kohout, T., Franchi, F., et al. 2021. The Impact and Recovery of Asteroid 2018 LA. *Meteoritics & Planetary Science* 56: 844–93.
- Lunning, N. G., Bischoff, A., McCoy, T. J., and Corrigan, C. M. 2018. Melt Clasts in R Chondrites: Indigenous and Foreign (Abstract #1552). 49th Lunar and Planetary Science Conference. CD-ROM.
- Metzler, K. 2018. From 2D to 3D Chondrule Size Data: Some Empirical Ground Truths. *Meteoritics & Planetary Science* 53: 1489–99.
- Metzler, K., Hezel, D. C., Barosch, J., Wölfer, E., Schneider, J. M., Hellmann, J. L., Berndt, J., et al. 2021. The Loongana (CL) Group of Carbonaceous Chondrites. *Geochimica et Cosmochimica Acta* 304: 1–31.
- Miller, M. F. 2002. Isotopic Fractionation and the Quantification of ^{17}O Anomalies in the Three Oxygen Isotope System: An Appraisal and Geochemical Significance. *Geochimica et Cosmochimica Acta* 66: 1881–9.
- Newton, J., Franchi, I. A., and Pillinger, C. T. 2000. The Oxygen-Isotopic Record in Enstatite Meteorites. *Meteoritics & Planetary Science* 35: 689–98.
- Rochette, P., Sagnotti, L., Bourot-Denise, M., Consolmagno, G., Folco, L., Gattacceca, J., Osete, M. L., and Pesonen, L. 2003. Magnetic Classification of Stony Meteorites: 1 Ordinary Chondrites. *Meteoritics & Planetary Science* 38: 251–68.
- Scott, E. R., and Jones, R. H. 1990. Disentangling Nebular and Asteroidal Features of CO_3 Carbonaceous Chondrite Meteorites. *Geochimica et Cosmochimica Acta* 54: 2485–502.
- Sears, D. W. G., Batchelor, J. D., Lu, J., and Keck, B. D. 1991. Metamorphism of CO and CO-Like Chondrites and Comparisons with Type 3 Ordinary Chondrites. *Proceedings of the NIPR Symposium on Antarctic Meteorites* 4: 319–43.
- Shearer, C. K., Burger, P. V., Neal, C. R., Sharp, Z., Borg, L. E., Spivak-Birndorf, L., Wadhwa, M., et al. 2008. A Unique Glimpse into Asteroidal Melting Processes in the Early Solar System from the Graves Nunatak 06128/06129 Achondrites. *American Mineralogist* 93: 1937–40.
- Stoeffler, D., Knoell, H.-D., Marvin, U. B., Simonds, C. H., and Warren, P. H. 1980. Recommended Classification and Nomenclature of Lunar Highland Rocks—A Committee Report. Conference on the Lunar Highlands Crust, Houston, Texas, November 14–16, 1979, Proceedings (A81-26201 10-91). New York: Pergamon Press, 51–70.
- Torrano, Z. A., Davidson, J., and Wadhwa, M. 2020. A Reclassification of Northwest Africa 2900 from CV3 to CK3 Chondrite. *Meteoritics & Planetary Science* 55: 2539–50.
- Warren, P. H. 1993. A Concise Compilation of Petrologic Information on Possibly Pristine Non Mare Moon Rocks. *American Mineralogist* 78: 360–76.
- Wasson, J. T., and Choi, B.-G. 2003. Main-Group Pallasites. *Geochimica et Cosmochimica Acta* 67: 3079–96.
- Wasson, J. T., Huber, H., and Malvin, D. J. 2007. Formation of IIAB Iron Meteorites. *Geochimica et Cosmochimica Acta* 71: 760–81.
- Wasson, J. T., and Kallemeyn, G. W. 2002. The IAB Iron-Meteorite Complex: A Group, Five Subgroups, Numerous Grouplets, Closely Related, Mainly Formed by Crystal Segregation in Rapidly Cooling Melts. *Geochimica et Cosmochimica Acta* 66: 2445–73.
- Wasson, J. T., and Richardson, J. W. 2001. Fractionation Trends Among IVA Iron Meteorites: Contrasts with IIIAB Trends. *Geochimica et Cosmochimica Acta* 65: 951–70.
- Weyrauch, M., Horstmann, M., and Bischoff, A. 2017. Chemical Variations of Sulfides and Metal in Enstatite Chondrites—Introduction of a New Classification Scheme. *Meteoritics & Planetary Science* 53: 394–415.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article.

Appendix S1. A complete copy of the text entries for non-Antarctic meteorites.

Appendix S2. Data including Antarctic meteorites.

Information about the approved meteorites can be obtained from the Meteoritical Bulletin Database (MBD) available online at <https://www.lpi.usra.edu/meteor/>.
