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Catalogue of Meteorites from South America

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Contents

Symbols and Abbreviations

S_n	Shock stage
W_n	Weathering grade
Fa	Fayalite
Fs	Ferrosilite
Wo	Wollastonite
χ	Magnetic susceptibility
L	Low iron chemical group
LL	Low iron, low metal chemical group
H	High iron chemical group
CO	Ornans chemical group
CK	Karoonda chemical group
CR	Renazzo chemical group
H_n, L_n or LL_n	Petrologic types
CO_n, CK_n or CR_n	Petrologic types
C2	Carbonaceous chondrite of petrologic type 2
A	Chemical group of irons
IVB	Chemical group of irons
Ni	Nickel
Mod	Moderate
Med	Medium

Chapter 1
Introduction

Today, it is clear that the interplanetary space between the planets of our Solar System is not a perfect void. Millions of small bodies are present there orbiting our Sun together with the large objects. If the small bodies are bigger than 100 m in diameter and they are composed of rocks and/or metals then they are called as *asteroids*. If they are integrated by ice then they are called *comets*. If they are smaller than 100 m in diameter then they are called *meteoroids*. In many cases, their orbits cross the orbit of our planet so they can get in direct contact with our atmosphere. When a meteoroid enters in our atmosphere and survives as far as to reach to the Earth's surface it is called a *meteorite*. So meteorites are small solid masses coming from the interplanetary space between the planets.

Meteorites are at present the most important and numerous sources of extra-terrestrial rock or metal samples for the planetary scientific research. They may come from fragments ejected from the surfaces of asteroids in collisions between asteroids themselves, and they may also be a pieces ejected in large impact events on the surface of our Moon and in the surfaces of nearby planets like Mars and Venus.

Meteorites are very old objects (4,600 to 4,000 Ma on average) so they are important to understand the events connected with the origin of our Solar System. They also teach us about the exotic geology and geochemistry of all these extraterrestrial bodies.

The names of meteorites are founded after the places where they are fallen or found, and they are classified into three wide categories and some subcategories.

Stony meteorites are composed mostly of mafic silicate minerals. There are two types: chondrites (primitive meteorites, with chondrules) and achondrites (differentiate meteorites, without chondrules).

Stony-iron meteorites have approximately equal quantities of metal and silicates. They comprise the pallasites and mesosiderites.

Iron meteorites are especially metal. They are classified into twelve major groups depending on their relative amounts of iron, nickel, and certain trace elements.

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1.1 About This Catalogue

South America is a very large continent with many different types of geological and geographical landscapes and terrains so quite large numbers of meteorites can be expected. However, the total number of meteorites from this continent only represents the 1 % of all the specimens obtained from the entire World.

One reason is that many large areas of South America are covered with dense tropical rainforests (e.g., the Brazilian Amazonas) that make extremely hard to find or recuperate meteorites. The very humid weather there also makes very difficult the preservation of samples. On the other hand, the enormous desert zones in many areas of South America (e.g., the Atacama's desert in the Pacific Ocean coast of Chile, Fig. 1.1) are prolific sources of exceptionally well-preserved specimens (Bland et al. 2000). There are about 70 % of South American meteorites came from this region and no less than 50 new specimens were reported just in the month before the close of the writing of this monograph. And only in the strewn field of El Médano have been collected more meteorites than in all the South American countries together, except Chile.

Similar geomorphological conditions of deflation surfaces can be identified in the Argentine Puna and Bolivian Altiplano, and these are also astonishingly promising terrains to find large numbers of well preserved new meteorites, but incredibly no systematic search has been performed and only a few meteorites have been discovered there.

Fig. 1.1 Atacama desert. *Credit*: Frans Swaalf

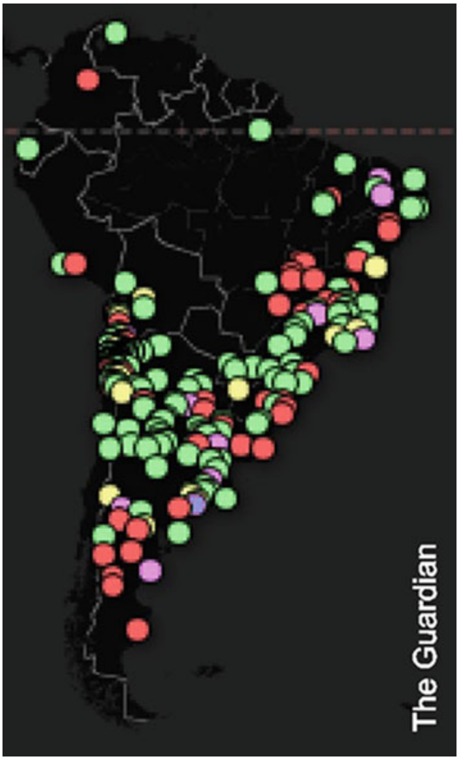

Fig. 1.2 Geographic distribution of South American meteorites. *Credit*: Simon Rogers, published in the Guardian. Mapped using CartoDB

But also most of the reported meteorite specimens from the rest of countries have been seen to fall by chance and found later or they were hit on by peasants plowing in the field.

This catalogue gives the basic information concerning each specimen like its precedence and the place where it was discovered (in geographic co-ordinates and illustrative map), the official name of the meteorite, its classification type (class, and if applicable, weathering grade and shock stage), if it was seen to fall or was accidentally found by a lucky chance, its total mass or weight, the institution who keeps it, and the most important bibliographic references about it.

Previous catalogs as Giacomelli (1969), Zucolotto (1999), Zucolotto et al. (1999), Grady (2000), Zucolotto and Antonello (2004a), Koblitz (2006), Acevedo and Rocca (2011) are also cited. However, the Database of the Meteoritical Society at http://www.lpi.usra.edu/meteor/metbul.php has been the main source of information for this new catalog.

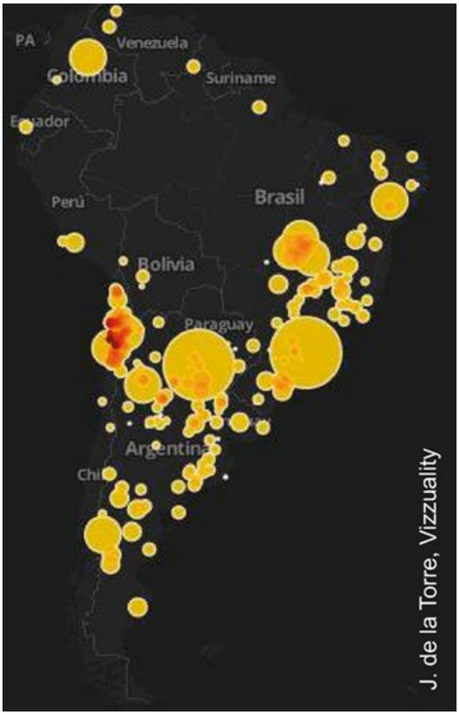

Fig. 1.3 Compared masses of South American meteorites. *Credit*: Javier de la Torre

1.2 List of Meteorites Found in South America

Figure 1.2 shows the geographic distribution of South American meteorites (falls e.g., Ecuador and finds e.g., Patagonia) and Fig. 1.3 are compared masses of the South American meteorites (displayed in proportion with the intensity of the tone and the size of the circles, that is, the largest the size of the circle and the tonality then the largest of the mass of the meteorite).

In brief, the falling of meteorites is a random event but the finding of old meteorites is focused in certain areas like, for example, in the desert of Atacama in Chile where meteorites are concentrated with the geological timescales. As it is expected, the rest of meteoroids were seen in populated and template weather areas.

So far, the number of meteorites specimens reported in this continent is 591, quantity that has been duplicated in the last year by the discovery of many new meteorite specimens from Chile.

The list displayed by country will be shown in the following chapters.

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Chapter 2
Argentina

"The earliest Spanish explorers to enter the region that now is northern Argentina heard marvelous stories from the Indians of a large block of iron that had supposedly fallen from the sky. The place where it lay was called Pigüem Nonraltá, or, in Spanish, Campo del Cielo (Field of the Heaven). In 1576 a military expedition visited the site, returning with a few small pieces of a very large mass, which came to be known as the Mesón de Fierro (Large Table of Iron) estimated to weight about 500 Q (23 mt)" (Cassidy et al. 1965). Campo del Cielo is the flagship of the Argentine meteorites. Chaco, the main mass, is the second largest known meteorite (as a single piece) at the Earth's surface.

Lists of all known Argentine meteorites were published by Giacomelli (1969), and Acevedo and Rocca (2008, 2010, 2011). In addition, data for all specimens hitherto identified (Fig. 2.1) are included here.

Argentine meteorites are protected by National Law N° 26,306. Any meteorite found or fall in Argentina is a cultural treasure of the Argentine Nation and its commerce is forbidden.

Achiras. 33° 10′ S, 64° 57′ W. Río Cuarto, Córdoba. Stone, olivine-hypersthene chondrite, (L_6). Fell on 1902, 780 g were recovered. Museo Provincial de Ciencias Naturales "Bartolomé Mitre", Córdoba (Argentina), Smithsonian Institution collections (USA), Natural History Museum (UK). Olsacher (1951a).

Agua Blanca. 28° 55′ S, 66° 57′ W. Pinchas, Castro Barros, La Rioja. Iron, octahedrite, (IIIAB). Collected in 1938, 49 kg obtained. Museo "Inca Huasi", La Rioja (Argentina), Natural History Museum. Herrero Ducloux and Loyarte (1939).

Aguada. 31° 36′ S, 65° 14′ W. Pocho, Córdoba. Stone, olivine-hypersthene chondrite, (L_6). Fell on September, 1930, 1.62 kg were recovered. Museo de Mineralogía y Geología, Facultad de Ciencias Exactas, Físicas y Naturales, Córdoba, Smithsonian Institution collections, Natural History Museum. Olsacher (1951b). Fig. 2.2.

Aguas Calientes. 25° 30′ S, 68° 24′ W. Catamarca. Stone, olivine-bronzite chondrite, (H). Find, 1971, 257 g.

Águila Blanca. 30° 52′ S, 64° 33′ W. Río Dolores, Punilla, Córdoba. Stone, olivine-hypersthene chondrite, (L). Date of find: 1920, 1.44 kg. Museo Argentino

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Fig. 2.1 Argentine meteorites. Modified from © 2013 Inav/Geosistemas SRL

de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires. (Herrero Ducloux 1939).

Árbol Solo. 33° S, 66° W. Socoscora, San Luis. Stone, olivine-bronzite chondrite, (H_5). Fell on Septiember 11, 1954, 809 g. Universidad Nacional de Cuyo, Mendoza (Argentina). The Permanent Commission on Meteorites of the International Geological Congress (1964b); Giacomelli (1969). Fig. 2.3.