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The Meteorite Collection in the Natural Science Museum of Turin[1]

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Abstract: The Natural Science Museum of Turin is the owner of a small but nice collection of meteorites, partly obtained by means of direct acquisition during the last 30 years, and partly inherited from the rather old collection of the University of Turin. This collection was partially forgotten for the last 50 years, and after 1936 the collection became almost invisible. In the last 30 years the meteorite samples were tightly packaged and retained in the basement of the museum building. Currently a new listing of the meteorite collection is in progress and almost finished, in which every sample is described, measured and weighed. For each sample the authors acquired high resolution images and examined historical documentations. Images were acquired with a desktop scanner, which was found to be an ideal tool for this purpose. A classification based on most famous meteorite catalogues is coupled to each description. About eighty samples (and probably a new meteorite, not described until now) will be depicted in the new catalogue, which hopefully will be published during 2009. The authors want to inform the international community that Turin the Museum holds an important collection containing almost all of the Piedmont meteorites (e.g. MOTTA DI CONTI, CERESETO, ALESSANDRIA), some Italian meteorites of considerable historical importance (TRONZANO, ALFIANELLO, ASSISI, SIENA), together with a selection of American and Eastern European samples.

Keywords: meteors, meteoroids — history and philosophy of astronomy

1 Introduction: A Bit of History

The history of the mineralogical and geological collections of the Turin University began in the first years of the 18th century, when the primitive nucleus of some early private collections were joined in two fundamentals centers of aggregation: the Natural History Museum of the Turin Royal University[2] (from this point called Museum of the University) and the Royal Academy of Science in Turin[3] (The Academy Museum, Gallo 2004). The first of these, the Museum of the University was founded in 1730, in a building situated near the Royal Palace, an historical one depicted in Figure 1, that still belong to the University and is now its administrative centre. The first organization of the museum forecasted five sectors: 'Physics', 'Mathematics', 'Botany', 'Anatomy' and 'Rare, Unusual and Precious Objects'. Please note that all the registered examples of stones and minerals were at the time collected under the section 'Botany'. Around 1750 Carlo Emanuele III[4] acquired some private collections of minerals, fossils and zoological samples, among them the important one of Vitaliano Donati, Professor of Natural History and Botany in Turin in 1750, who studied the mineralogical resources of Savoy and Aosta dukedom, and the one of the Conte Gio. Battista Carburi di Cefalonia, a physician Professor of Medicine at the Turin University in 1750, and also a collector of natural science samples. All of the collection was gifted to the Royal University, and this was the very beginning of the Museum, at that time called 'Museum of the University', a name used for long time (Gavetti & Vellano 2000). The second centre of aggregation dates to about thirty years later, in 1759, when another Natural History Museum was set up, among the 'Società Privata Torinese[5]'. In this museum were gathered some private collections of the associated, prominent personalities of the scientific, economic and political–social spheres of that epoch. These two important collections were submitted to the trouble of the historical period, a time of deep and fast changes for the Sardinian Kingdom. During the Sardinian exile of Carlo Emanuele IV

[1] Piedmont, Italy.
[2] Museo di Storia Naturale della Regia Università degli Studi di Torino.
[3] Reale Accademia delle Scienze di Torino.
[4] Carlo Emanuele III of Savoy, son of Vittorio Amedeo II, was the 2nd King of Sardinia and reigned between 1730 and 1773, one of the longest kingdom in the Savoy dynasty.
[5] The 'Società Privata Torinese' (the translation could be 'Turin Private Association') became in 1783 the Royal Academy of Science in Turin, after royal will and ruling. Amongst the founders one can find eminent mathematicians like Luigi Lagrange, and physicists like Giovanni Cigna.

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Figure 1 The historical building of the University of Turin, first location of the Royal Museum of Natural History (1730).

Figure 2 Palazzo Carignano, seat of the First Italian parliament in 1861 and, from 1878, of the Mineralogical Museum of the University.

(nephew of Carlo Emanuele III), under the French occupation of Piedmont, Stefano Borson[6] was entrusted with the classification and cataloguing of the Natural History Museum of the Royal Academy of Science (former Private Association). During 1801, the task was extended also to the University Collections and Museum. But the two above-mentioned organizations were merged in 1805, owing to a Napoleonic edict (Piedmont at that time was a French 'Department'), giving rise to the Turin University Royal Museum of Mineralogy, one of the most important museums in Europe at the end of the 19th century, with more than 13 000 samples (Clari & Trossarelli 1978). Despite the Napoleonic edict of about a century before, the two collections were still located in two places until 1878, when Giorgio Spezia[7] organized and supervised the moving of all the samples and materials into Palazzo Carignano (Figure 2), the most important edifice of the Savoy–Carignano family in the centre of Turin. Palazzo Carignano that became during time the seat of the first Italian Parliament (1861) but also, starting from the beginning of the second half of the 19th century, the place of a small clump of University Museum (Anatomy, Anthropology and Ethnology, Geology and Palaeontology, Systematic Zoology and, obviously, Mineralogy, Galloni 1991).

In 1810, Borson was designated as First Professor of Mineralogy, a professorship just created in the Turin University. At the same time, he was also designated as Director of the Museum of Mineralogy, and in 1810 he printed the first edition of the 'Catalogue Raisonné de la collection minéralogique du Musée d'Historie Naturelle[8]', containing the description of 3081 mineral samples. The second edition (Figure 3), edited by Borson in 1830, describes 6027 mineral samples, 1486 rock samples, 784 marbles and polished stones and 1605 fossil samples for a sum of 9902 samples (Clari & Trossarelli 1978). After the death of Borson in 1832, the direction of the Museum was entrusted to Angelo Sismonda[9], former Assistant at the School of Mineralogy. Sismonda acquired many very important and aesthetic samples for the Museum, and he organized the collections and the catalogues in the modern way — of that epoch. The 'Gran Catalogo' (Big Catalogue) of the collection, a manuscript still used for the registration of the new acquisitions or new findings in the University collection, is set up of twelve big sized and very fragile old volumes, containing today more than 13 000 samples (some composed of several sub-samples). After the death of Sismonda, in 1878 the direction was committed to Giorgio Spezia, the one who made the final transport of the collections into the Palazzo Carignano. The next year the mineral collection and the geological and paleontological collection were disjoined, with the latter having the Direction of Bartolomeo Gastaldi. From that moment the two Museums, the Mineralogical one and the Geological and Paleontological one, followed different paths and histories. Anyway, Sismonda and Spezia made a politics of acquisition and growing of the Museum, and the visible effect of their action is noticeable in Figure 4 which illustrates the incredible rise of the collection during the

[6] Abbot Stefano Borson, born in St. Pierre d'Albigny (Savoie, 1758) graduated in Theosophy at the Turin University in 1781, and after long years of trips around Italy oriented his interest on natural sciences. In 1810 he was designated as Professor of Mineralogy in Turin, maintaining his role until his death, during 1832.

[7] Giorgio Spezia was born in Verbania province (Piedmont) in 1842, and after a break in his studies for being a Garibaldi soldier, graduated at Polytechnic of Turin in 1867. He became director of the Museo di Mineralogia of the University in 1878, and among others he was President of the 'Club Alpino Italiano'. He also was the first scientist obtaining, at the beginning of 1900, the laboratory growth of synthetic quartz, which became of primary importance after WWII for the developing of electronics.

[8] We should remember that during a long time in the history of the Savoy kingdom, in Piedmont the official language was French.

[9] Angelo Sismonda (born in Corneliano d'Alba in 1807) was student of Borson in Turin and completed his studies in Paris. Called to the position of First Professor in Mineralogy (and Director of the Museum) at the Turin University in 1832, he continued his role for over forty years until his death in 1878. He was highly estimated by King Carlo Alberto di Savoia, and he was preceptor of the King's heirs.

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Figure 3 The second edition of the 'Catalogue Raisonné de la collection minéralogique du Musée d'Historie Naturelle' edited by Borson in 1830. This copy is of particular importance because it was the one, covered with red leather and engraved with the pure gold monogram 'CA', donated to Carlo Alberto of Savoy, King of Sardinia.

1832–1923 period (Gallo 2007). The last years of the 19th century and the time elapsed between the first and second World Wars stopped the developiment of the Museum collection. The Mineralogical collection was hosted in Palazzo Carignano until 1936. In 1944 the monument suffered some damage due to the bombing of Turin, but fortunately the minerals (and the Museum) were hosted in the new seat of the Institute of Mineralogy, Petrography and Geochemistry that grew up in a portion of an historical edifice formerly used as hospital[10]. The Mineralogy Museum of the University of Turin was despite not useful, the collections were normally not accessible to the public, and only students and Professors were admitted to observe and study the samples. The collection did not have enough space for the exhibition and only few of the 13 000 samples were shown, in old fashioned wooden furniture (Figure 5). That uncomfortable situation continued until 1980, when some stability problems of the building suggested movement of the collections in the newborn Museum of Natural Science of Turin, where the checking and cataloguing started from the minerals, delaying the observation and restoration of the meteorites samples until the last year (2007). The Museum of Natural Science of Turin (MRSN)[11] is a recent institution. It was founded in Turin by will of Regione Piemonte in 1980, and it preserves, among others, the Mineralogical, Petrological, Geological and Paleontological historical collections of the University of Turin, and increases its own collections. Starting from that point, the MRSN has acquired more than 15 000 new samples of minerals, so the joined collections of the University and MRSN (nearly 65 000 among minerals, rocks and meteorites) can be considered one of the most important of Italy and Europe. Despite its location, the university collection still remains under university ownership, but the MRSN is the trustee of the samples, with the aim of study and valorize them, and promote their knowledge.

2 The Old Meteorites Collection

Although some meteorites were collected before 1850 as 'curiosities' (the spirit of wonder typical of the 18th century *wunderkammern* was still alive), the starting of the Meteorite collection of the University is probably due to the contemporary presence of several circumstances. First, after the pioneer works of Chladni at the end of 18th century, and the works of Howard (the first to chemically analyze a meteorite in 1802), von Reichenback (the first who studied a meteorite sample with a microscope in 1857), and Story-Maskelyne (the first to apply the polarized microscope investigation to meteorites in 1863), the scientific community recognized at the beginning of the 1800s the meteorites as very important samples coming from a source beyond the earth. The second circumstance could be the fall in Piedmont, the 1840 July 17, of an important meteorite today known as CERESETO (Figure 6): it is an ordinary H5 chondrite of about 5–6 kg that hit the earth near the little city of Casale Monferrato, now in the Alessandria province. The stone was sent to the museum and Angelo Sismonda started a very tight correspondence with other museums, exchanging small slabs of the CERESETO chondrite for pieces and slab of other meteorites, like ORVINIO, HESSLE, STAUNTON, BOHUMILITZ, MILENA, EAGLE STATION, ASSISI, BRAUNAU, TRENZANO, FOREST CITY, COLLESCIPOLI, WICHITA. At the Museum is preserved a manuscript composed of a few pages: the 'Meteorite catalogue of 1886' (Figure 7), in which one can find the registration of about fifty meteorites, almost all obtained from exchanges and some by acquisition or inheritance. Some Italian meteorites, and first of all the Piedmontese ones, were also sent to the Museum for investigative purposes. It was not so unusual at the time (or now), when people found some strange kind of rock, for them to send it to the institution for study and investigation.

[10] The Hospital of St. John the Baptist, a baroque brickwork building founded in 1680 under the supervision of Amedeo di Castellamonte.

[11] Museo Regionale di Scienze Naturali di Torino is the correct Italian name.

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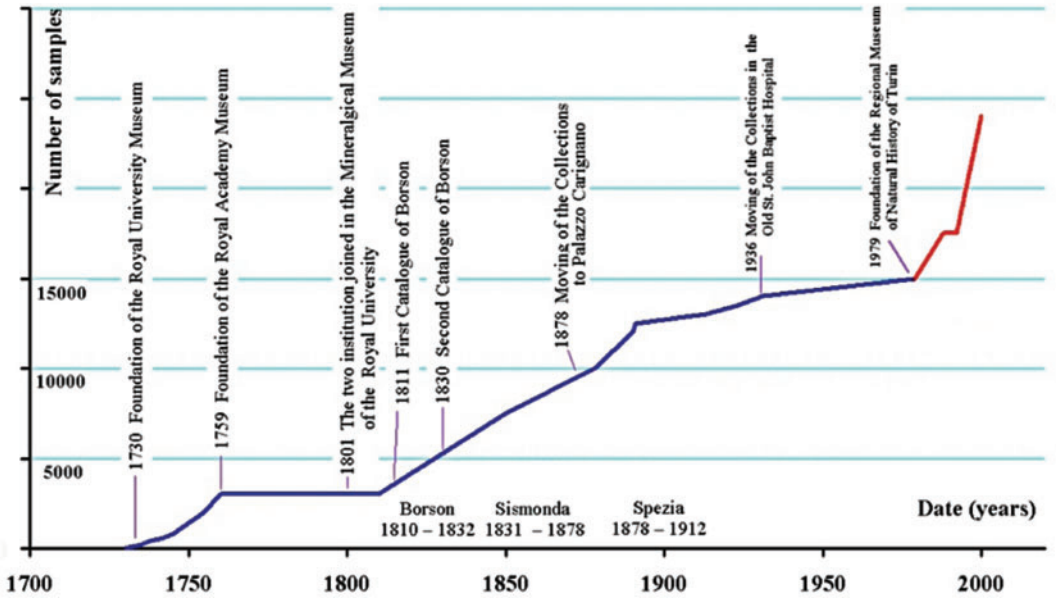

Figure 4 The rise of the collection during the period 1730–2000. The action of Borson, Sismonda and Spezia is really noticeable. (Redrawn from Compagnoni & Peyronel 1995.)

Figure 5 The Mineralogy Museum of the University hosted in the 'Old Hospital of St. John the Baptist', 1970.

Another catalogue, the 'Exchange Catalogue', describes for each slab of CERESETO the weight given to other scientist and Museums and the materials and weight obtained in exchange from these Institutions.

3 The Rediscovery of the Turin Meteorites Collection

During the last 50 years the Meteorite collection, although not really forgotten, was hidden and untouched in some wooden and plastic boxes, stored in the basement of the Mineralogy Museum of the University before, and in MRSN after, 1980. In any case very few people were interested in such meteorites since the beginning of the 1950s. So, an historically and important collection was essentially unavailable for scientific investigation for about 50 years. No scientific papers reporting the existence of the collection were published, only some information can rarely be found about a few samples, in two or three meteorites catalogues around the world. At the end of 2007, during the re-cataloguing of the university collection, these boxes were chosen and the samples observed, recognized, cleaned, measured and weighted, a new description was made, and image documentation was elaborated. What was found can be summarized as follows:

Figure 6 The CERESETO (M/U 2555.1) H5 chondrite, as it is today in the collection of the Natural Science Museum of Turin. On one side of the sample is clearly noticeable the cutted portion taken by Sismonda and used for exchange with other museums.

- about 80 samples of a total of 58 different meteorites;
- 72 samples from the historical collection of the University;
- 9 samples from recent acquisition by the MRSN;

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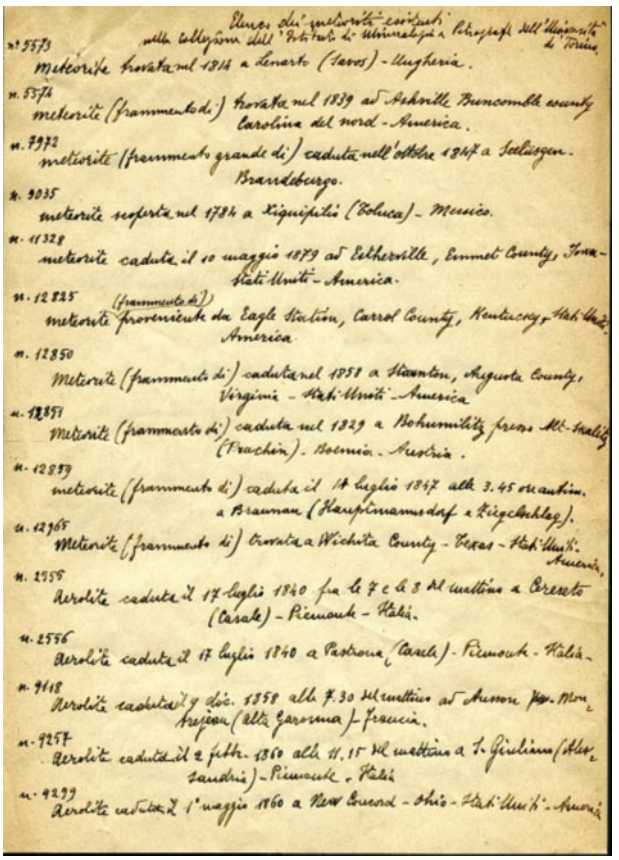

Figure 7 First page of the 'Meteorite catalogue of 1886'.

- one brand new meteorite (fell in 1935!), not described until now but accompanied by historical documentation (authors of this note are still examining it with SEM–EDS for a sure identification of the meteoritic nature of the sample);
- a lot of historical documentation (letters, catalogues, notes, drawings and so on);
- some unknown samples that only seem to be meteorites, with poor description and documentation: homework for the coming years!

At the moment the authors are preparing an edition of a new catalogue containing:

- a description of each sample;
- classification of the samples (deduced from existing catalogues, because we are not so expert!);
- pictures of each sample;
- historical notes with pictures and translation.

Points of interest of the collection are:

- the presence of almost all of the Piedmont's Meteorites (MOTTA DI CONTI, CERESETO, ALESSANDRIA) that fell before 1900;
- a good excerpt of the Italian Meteorites (like SIENA, ASSISI, ALFIANELLO, etc.);
- samples of some famous meteorites like ORGUEIL (88 g!), hidden in the collection for about 120 years and not listed even in one of the most important catalogue in the World (Grady 2000, cf. Figure 8);
- unique samples like MOTTA DI CONTI, of which Turin preserve the biggest mass of about 6.3 kg (Figure 9).

Figure 8 The sample of ORGUEIL (M/U 9666.1) carbonaceous chondrite (88 g in two pieces) preserved in the original glass vessel.

Figure 9 MOTTA DI CONTI H4 chondrite (M/U 10006), fell near Alessandria (Piedmont, Italy), 1896 February 29. The mass is about 6300 g.

4 Meteorite Pictures: the Scanner Option

One of the most important goals of the new catalogue is the complete description of the samples, including high-quality images. But obtaining a good picture of a meteorite can be a difficult task. Meteorites are often very dark subjects, and their tri-dimensionality is a challenge for any depth-of-field. Moreover, one could also encounter some problems on colour rendering. Colour rendering depends

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Figure 10 The scanned image of ALESSANDRIA (M/U 9257.1). One can note the good resolution and colour rendering, the scale bar, the catalogue number and the Kodak® Gray Card used behind the catalogue number for colour check purpose.

Figure 11 The scanned image of CERESETO (M/U 2555.1), with a magnified portion that shows resolution and details that one can achieve using a scanning resolution of about 2400 dpi.

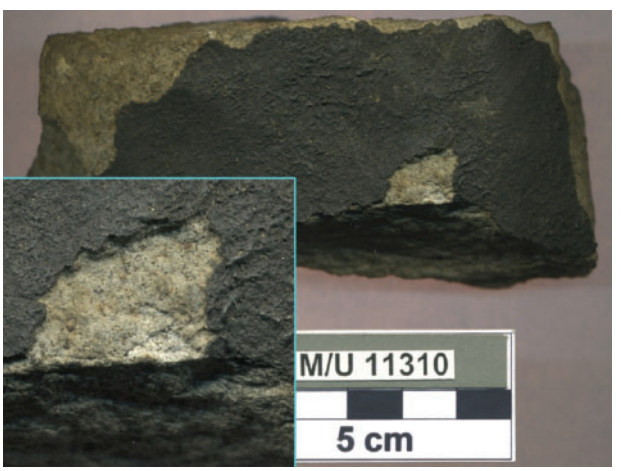

Figure 12 The scanned image of ALFIANELLO (M/U 11310), with a magnified portion that shows resolution and details.

on camera, the lenses, the film or CCD device (in digital pictures), the light used, as well as the printer options and/or monitor options. The authors tried to acquire some high resolution digital image with some 'colour check' inside. The results were imperfect but useful for a practical use. Without expensive checking software and a professional monitor, the authors chose to use a flatbed scanner (Epson 2400) to scan the whole meteorite, as shown in Figures 10–12. Included with the sample was a scale bar containing the reference number of the sample itself, as stated by the Museum catalogue, and a small patch of Kodak Gray Card for colour reference purposes. Several advantages of this system are the following:

- virtually no distortion due to the camera/subject angle (any distortion can be simply checked by acquiring a picture of a millimetred paper sheet);
- good depth of field (not on all scanners, however);
- any size of pictures with no loss of resolution (at dpi ranging up to 4800) with dimensions from few millimetres to A4 size (unless one has an A3 scanner);
- no deep shadow on the subject because of direct illumination from the scanner light (sometimes one can have problems with very reflective subjects);
- almost no vibration;
- no lightbank, no flash, no light meter, no expensive cameras, only need to check the brightness/contrast/colour options of the scanner software;
- a lot of information on the same picture, from the large view to the small portion and detail, simply zooming in the image:
- a simple method to check the colour and appearance of the sample on your monitor: compare it with a Kodak Gray Card (it is inexpensive and can be found in almost any camera shop), and adjust the brightness–contrast control of your monitor until the grey on the monitor become similar to the grey of the card;
- scanned images can have any dimension, depending by the size of the object and the specified resolution. But with high resolution one can obtain impressive details of the subject simply by zooming in the picture with viewing software.

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Table 1. Inventory of Italian meteorites in the collection

Name (Classification)	Mass (g)	Dimensions (mm)
ALESSANDRIA (H5)		
M/U 9351	55.9	42 × 35 × 26
M/U 9257.1	84.4	36 × 37 × 30
M/U 9257.2	1.4	–
M/U 9257.3	1.3	–
ALFIANELLO (L6)		
M/U 11310	616	118 × 52 × 47
M/U 15443	108.9	55 × 37 × 32
M/ 12289	26.4	46 × 28 × 18
ASSISI (H5)		
M/U 12858	198.8	52 × 44 × 41
CERESETO (H5)		
M/U 2555.1	1891	114 × 99 × 92
M/U 2555.2	31.2	39 × 29 × 19
M/U 2556.1	1307	115 × 114 × 69
M/U 2556.2	0.9	17 × 10 × 6
COLLESCIPOLI (H5)		
M/U 12963	79.1	45 × 38 × 31
MOTTA DI CONTI (H4)		
M/U 10006	6311	212 × 193 × 116
ORVINIO (H5)		
M/U 11276	77.7	48 × 36 × 31
SIENA (LL5)		
M/U 2559.1	4.2	18 × 11 × 12
M/U 2559.2	2.9	16 × 14 × 10
M/U 11278	53.7	42 × 35 × 17
TRENZANO (H6)		
M/U 12961	144.96	47 × 37 × 47
VIGARANO (CV3)		
M/U 14054	30.71	41 × 42 × 9.5

But, Caution! A very heavy sample can break the scanner window! For this reason, the authors have not yet dared to scan one of the GIBEON samples of about 12 kg. Example images demonstrating the achievable quality of the scanner at low and high resolution are shown for the meteorites CERESETO (Figure 11) and ALFIANELLO (Figure 12). Note also that the scanner is obviously useful for digitizing any paper documentation, such as historical notes or drawings.

5 The Italian Meteorites

At the present time the work is still in progress, but the authors would like to add to this article the inventory of the Italian Meteorites in the collection; the complete list will be submitted to the Meteoritical Society as soon as possible. The list is shown in Table 1, in which, after the row containing the meteorite name and classification, the other rows reports the catalogue number, the mass in grams and the dimension in millimetres. Regarding the catalogue number, the abbreviation M/U indicates 'University Museum', the old historical collection of the University, while M/ indicates 'Natural Science Museum', the new collections acquired by the MRSN after his foundation in 1979.

6 Conclusion

We hope to send to press the new 'Meteorites catalogue of the Turin Museum of Natural Science', with as much information and pictures as possible, by the middle of 2009. The new catalogue will be bilingual, Italian/English; and upon being printed, it will automatically enter into the 'exchange net' between Natural History Museums in the World. This article is the first announcement to the scientific world that the meteorite collection is now recovered and restored to the attention of the international scientific community. So one of the main aims of the MRSN, to emphasize and valorize such important samples, can be regarded as achieved.

Acknowledgments

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