Meteorites from Indian subcontinent, a brief. R. R. Mahajan[1], [1]Physical Research Laboratory, Ahmedabad-380009, India, (email: ramakant@prl.res.in).

Introduction: Immediate collection, documentation, preservation and characterization of meteorites falling on Earth is essential in many aspects. Before the age of satellite era, the objects fall on Earth were solely the extra-terrestrial rocks, the meteorites. However, in the present space age, the debries or fragments of rockets from satellite launches poses a serious difficulties to distinguish the event of fall of meteorite with that of space junk. The present work is to systematically look for the flux of meteorite during last 219 years in Indian subcontinent. The oldest record of meteorite fall is of Jalandhar in 1621 [1], an iron meteorite.

Discussion : The meteoritical society database (online, accessed on 9 Jan 2017) has the record of falls as 137 meteorites [1] from India. It also lists two craters, Lonar and Dhala [1], and remaining 11 number as find or undocumented events (may be falls?) [1]. The total falls around the globe is 1297 [1] and thus the meteorites (fall and subsequently recoveed) from India are > 10% as compared to total number of falls. United states, have 161 falls from year 1807 [1] although the total collection of meteorites recorded is of 2151 meteorites. China has 233 total meteorites, out of which 65 are falls and from year 1827 [1]. Russia has total meteorite 50 and falls are 14 meteorites [1] from year 1805 including the famous fall at Chelyabinsk in year 2013.

Table 1. Meteorites fall statistics for few countries listed areawise.

Country	Total number of meteorites	Falls	Record of falls from the year	Area (approx.) 10^6 km^2
Russia	149	50	1805	17.1
Canada	77	17	1850	9.9
China	233	65	1827	9.6
United states	2151	161	1807	9.5
Brazil	76	28	1833	8.5
Australia	742	18	1864	7.7
India	148	136	1798	3.3

Other countries with larger geographical area are considered, Brazil with 76 total, and 28 falls whose record is from year 1833 [1], Australia with total listed meteorites 742 and 18 falls from year 1864 [1] and Canada have 77 meteorites listed, 17 falls from the year1850 [1]. The area, number of falls during last two centuries worldwide is listed in Table 1.

Few resent falls :

The meteorite fall at Katol, near Nagpur in Maharashtra, was a shower event. Initially only few fragments were collected [2] however the total collection went to 13 Kg [1] in further search and collection from the strewn field. It is classified as L(6-7) chondrite, and have cosmic ray exposure age (CRE age) of 40-50 Ma [3]. The temperature was extremely high, 48^{o}C when this shower took place (April, 2012) and some fragments penetrated the tin shelter of a household (Fig. 1) indicating high velocity impact.

Fig. 1 Tin shelter showing the hole made by one of the small fragment of Katol shower meteorite.

A small pit was made by the larger piece of mass ~1 kg in Katol shower, but was disturbed by human activity immediately after the fall [Fig. 2].

Fig. 2. Pit made by the larger fragment of meteorite at Katol.

The Sulagiri meteorite, fell in 2008 in the state Tamil Nadu, the collected fragments have mass 110 Kg [1] from India, and belongs to LL6 ordinary chondrite class. Sulagiri have the CRE age of 27.9 Ma [4]. The smallest mass is 100 g of Jodiya, an L5 chondrite fell in 2006 [11]. The recent fall, Kamargaon in state Assam belongs to L6 class [1] and have CRE age of 7 Ma [5].

There are 23 falls and one find during last three decades [4] in India as documented including the latest fall at Kamargaon [5]. Out of which 18 are ordinary chondrites, two iron [7, 8] and three belongs to HED [9,10] class of meteorites. Thus, the ordinary chondrites dominates among the falls in last three decades.

Flux estimation: Most of the records are from year 1798 [1] for the meteorite fall. There are 136 meteorite fall recorded from 1798 to 2016. Thus approximately one meteorite fell in every two years duration in this period. The falls are in approximate total area of $3.3x10^6$ km^2. Therefore the estimated flux of meteorites is 0.19 meteorite/year/10^6 km^2. This estimate is only 0.1 % compared to estimates of 190 number per 10^6 km^2 per year for mass of meteorite > 10 g by Bland et al. [6] for a long term. Although this present flux of meteorites is based on falls recorded (and finally recovered the meteorites from the localities) spread over last 219 years, this is of its first kind estimate for Indian subcontinent. The meteorite mass range considered is from 100 g to 110 kg [1] of recovered meteorites.

Remarks: The present population of meteorites (falls) remains small. Therefore, there is possibility that more meteorites could have fallen in this region but unnotices, undocumented and hence a dedicated hunt of meteorites is required.

References:

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