

A Probable Meteor Impact Crater in Kashmir Valley (India)

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Abstract: Dal lake in Srinagar Kashmir (India) which falls towards south is a lake surrounded by mountains on its three sides with a latitude of $34^{\circ} 2'$ north and longitude $74^{\circ} 4'$ east, is a probable meteor impact crater, almost Basin shaped and is spread over an area of 12 sq k ms. In this paper we report some preliminary observations about it and invite the attention of international community of scientists towards its existence and studies and to establish finally whether or not it is a meteor impact crater.

Key words: Meteor Impact; Ancient observations; Lake; Metamorphism

1. Introduction:

A meteor entering into Earth's atmosphere can undergo fragmentation. Ignoring the slowing effects of travel through atmosphere, the impact velocity of an object from space is in the range of 11 km/s -72 km/s H. J Melosh (1989). Impact of such objects can produce shock waves in solid materials and both impactor as well as material impacted is rapidly compressed to high density and upon de-pressurization it explodes violently to produce the impact crater. In order to identify the impact crater, we must study some of the distinctive facts of an impact crater like the presence of rock that has undergone shock metamorphic effects such as shatter- cones, melted rocks and crystal deformations Charles W.A

and Anderson Leif (1978). Shock metamorphic effects include a layer of shattered or brecciated rocks under the floor of the crater Bond, J.W. (1981). Another mark of an impact crater is the presence of some elements like Ni, Pt, Ir, and Co which are not usually found in the Earth's interior Melosh, H.J. (1989). The presence of Maskelynite i.e. glassy type material at the impact site is also one of the distinctive features of an impact crater.

Meteor impact craters like Barringer Crater also called as Meteor Crater in Arizona United States (Hoyt, 1987; Shoemaker, 1963) and the Lonar Crater Lake in Buldhana District of Maharashtra India Fredriksson *et al.*, (1973) are rare on Earth's surface. It is said that some 52,000 years ago, a huge piece came from space and hit the Lonar creating a Crater of about 1830 mts in diameter and 150 mts deep. The Lonar crater has water in it and is one of the biggest meteorite craters having Basalt in it; this crater has a large slope with a dense forest in the region. The two slopes within the crater are 15 to 18 degrees and 30 degrees. The slope measuring 15-18 degrees has a notch through which the Meteor came. The opposite side of slope is increased due to the pressure created by the Meteor and by the remains of the notch side blown away. The pH value of water in Lonar crater is 10.5 which is more than normal. Salts and minerals like sodium, chlorides, fluorides and bicarbonates have been found in this Crater. The Lonar crater has been proved to be caused by an Aerolite Meteor (contain mainly rocky material) because no metal fragments have been found strewn around the crater. In the Lonar Lake, rocks have undergone shock metamorphism. The impact also produces high temperature and pressure as a result of which certain new minerals are formed and rocks get melted and turned into glassy materials. Before the impact the meteor has fragmented in three pieces and has led the formation of three lakes known as Lonar Lake, Ganesh Lake and Amber Lake. The Ganesh Lake and Amber Lake are dried up now. This crater has a great importance for studying our probable meteor impact. We have made use of such kind of comparative studies to study the formation of Dal Lake in Srinagar Kashmir due to an impact Meteor Crater. In section 2nd we discuss the actual geography and the

location of Dal Lake and report its preliminary investigations that have led us to think about the Meteor impact Crater.

2. Our Studies.

2.1 Geographical location of Meteor Impact.

Dal Lake is situated in Srinagar city having latitude of $34^{\circ} 2'$ north and longitude $74^{\circ} 4'$ east. The circumference of the Dal Lake is about 10 miles. It has been reported that in 1200 AD Dal Lake was spread over an area of 75 km and by 1980 over an area of 25 sq k ms Bano R and Maqbool M (1960). The lake is surrounded by mountains on its three sides. To the southern side of the Dal there is a mountain called Shankacharya, to the eastern side the hill is known as Zabbarwan and to the west side of the Dal the hill Koh-i-maran is holding its position. This kind of geography of Dal Lake probably indicates a Meteor impact which might have struck the earths surface from northern side of Dal and have given rise to the formation of these mountains (figure 2). Just like Lonar Lake, Dal Lake is also surrounded by dense forests and temples. The beautiful Lake has shrunk from 25 sq km to 11 sq km and attained various shapes from time to time owing to both natural and human induced causes Shiekh A.H (2006). From the map (figure 3), it is evident that the shape of the Dal is almost Basin like and probably the shape has deformed from its actual basin type due to the above reasons.



Fig 1; An Overview of Lonar Meteor Creator in Buldana District of Maharashtra.



Figure2; Mountains surrounding Dal Lake.

2.2 Our Preliminary Investigations.

Lonar Lake in Maharashtra India is a confirmed impact Crater on the basis of the study carried out for knowing certain facts like:

1. More pH value of water than the normal water.
2. Basin shaped structure of the Lake.
3. Presence of Basalts and Bressia rocks.
4. Presence of different elements which are not usually present in the earth's crust.
5. The presence of shock metamorphic effects

These scientific confirmations have been carried out by Gilbert G.K(1986); Cotton C .A(1952); Nandy N.C(1961); Eugene C Lafend & Dietz S Robert(1964); Fredricson K(1973) and others.

Our preliminary observations on Dal lake reveal that the pH value of the water present in this lake varies from 8.60 to 9.00 i.e more than the normal . From isotopic analysis of Lonar crater sample, the possible elements found in Lonar lake are: *Ba, Rb, Sr, Pb, La, Pr, Ce, Nd, Sm, Gd, Ho, Tm, Y, Hf, Nb, Eu, Tb, Er, Yb, Lu, Th, U, Zr, Ta, Sc and V* Chakarbarti and Basu(2006). During our scientific investigations a number of samples of mass 10-20 gms were collected from the banks of Dal lake, from the mountains as well as from the interior of Dal lake for processing to carry out its experimental studies like to determine the isotopic contents of the sample. Such kind of experiment has been recently carried out at Tata Institute of fundamental research (TIFR) Mumbai India in January 2008 with the scientists in the nuclear research lab. The experiment was carried out by the process of Coulomb excitation and titled as “Isotopic abundances of soil samples via coulomb excitations”. In its first phase the main objectives were

1. To determine the isotopic analyses of soil sample from Dal Lake.
2. To determine the formation of Dal Lake on the basis of impact Crater from the isotopic abundance.

The experiment was carried out at the 14MV TIFR Pelletron accelerator. In the phenomena of coulomb excitation, the EM interaction between energetic charged particles and the coulomb field of the target nucleus raise the target nucleus from its ground state to an excited state. The properties of nuclear states can be determined from the intensity and angular distribution of the gamma rays and the scattered projectile. The characteristic gamma rays from the excited states help in identifying the nuclides. The level schemes of the coulomb excitation is shown in figures(4) and (5). Initial results have shown the presence of following elements *Ba, Rb, Sr, Pb, La, Pr, Ce, Nd, Sm, Gd, Ho, Tm, Y, Hf, Nb, Eu, Hg, Ge, F, As, Se, Tl, Pt, Nb, Fe, Mg and Cd* .

Also from the Geological studies, Dal lake bed sediments are enriched in the elements like Al, Ti, Zn, Cu and Co and depleted in Ni and Mn Jeelani G and Shah A.Q (2006). In the surrounding mountains of Dal lake i.e north west Himalyas, metamorphosed rocks of markedly arenaceous composition has been found Wadia D.N(1953). According to geological studies at Gagribal (one of the basins of Dal lake) an intimate association of the two kinds of rocks is seen which have undergone metamorphism Wadia D.N (1953). The lake sediments are enriched relative to carbonates, reflecting the least contribution from the basalt although the catchments area of the lake is dominated by basalt Jeelani G and Shah.A Q (2006).

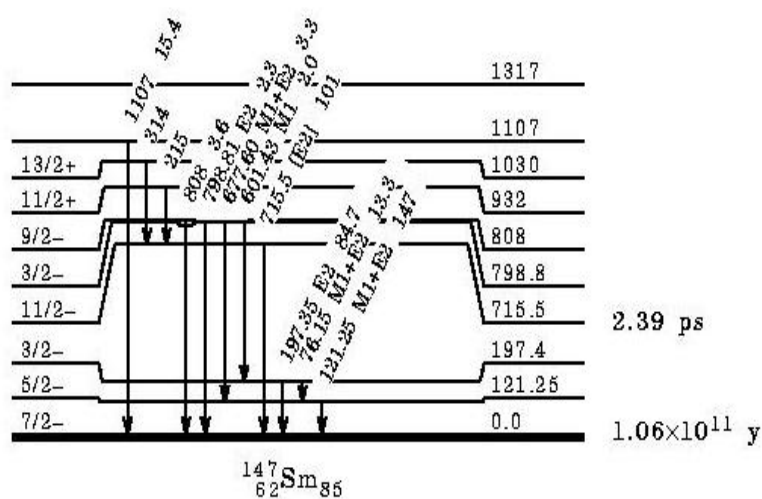


Figure (3); Shape of the Dal Lake Changed from its basin shape

Coulomb Excitation

Level Scheme

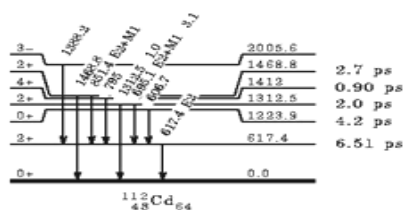
Intensities: relative $I(\gamma+ce)$



Coulomb Excitation

Level Scheme

Intensities: relative I_γ



Figure; 4 (top) and 5(bottom) show level schemes of coulomb excitation.

2.3 Comparison of Dal Lake with Lonar Lake.

From these scientific investigations it becomes very easy to go for the comparison of the two lakes and it seems very interesting that our preliminary results are almost in good agreement with the results obtained already for the Lonar Lake. For e.g., the pH value of the water in Lonar lake is about 10.00 which is very close with the pH value of the water in Dal Lake ranging in between 8.60 to 9.00. Secondly the presence of elements in the Dal Lake is about 70% closely matching with the elements present in Lonar Lake and also the presence of the Basalt and metamorphic effects in the surroundings of Dal Lake also exist in the Lonar Lake.

3. Conclusion and future remarks.

Ancient astronomy is a field of astronomy that is concerned with understanding and exploring profitably the astronomical information contained in ancient records. It has become very important to look for the ancient astronomical records. However, there are number of ways by which one can study about the ancient astronomy. It is very unfortunate that scholars have not given a serious thought about this field. The main advantage of this will be that it simply provides a window to look for the past astronomical records. The concept of meteor impact can not be only important in the sense that we are looking for this past astronomical record but is very important in a way that so many new ideas are associated with this event. For e.g. the formation of Lonar lake in Maharashtra and now the formation of Dal lake in Kashmir. Our main idea that the meteor has some time hit the Kashmir valley becomes an interesting future research work in which Astronomers, Geophysicists, Archeologists, and Historians can share their valuable experiences in studying the probable meteor impacts. We would like to mention here that the formation of Lonar Crater was confirmed when its results were compared with the Arizona Crater(USA) and therefore we have followed the same understanding in which we confirm to some extent that there is a probable meteor impact in Kashmir which has led the formation of

Dal Lake. However there are number of scientific ideas which need to be confirmed in future for e.g. to look for the presence of metamorphic effects, presence of Breccia rocks and Meskelnite rocks inside the Dal lake. Our preliminary observations indicate that Dal Lake is not an ordinary Lake, nor is it stream and may also not be of volcanic origin, but, in all probability it seems to be a very old and eroded meteor impact Crater. However, remains to establish it finally as a meteor impact Crater and to determine its age and also the velocity with which the meteor has striked the earths surface.

We would like to invite attention of international community of scientists towards the existence and studies of this probable new meteor impact Crater.

Acknowledgements.

The authors are grateful to Jamsethji Tata Trust Mumbai for their funding in studying the past astronomical records. Two of us (Naseer Iqbal and Aijaz Ahmad) are grateful to interuniversity center for astronomy and astrophysics(IUCAA) Pune India for their support and facilities to carryout this work. We are very much thankful to the nuclear scientists namely Dr. Paresh Joshi, Dr. I. Mazumadar and Dr. R. Palit of nuclear research lab TIFR Mumbai for extending their support in carrying out the Isotopic Abundance of soil samples via coulomb excitations. Thanks are due to Dr J Jeelani and Dr Bashir Ahmad of the department of Geophysics for helpful discussions and useful suggestions. We would also like to thank Dr Aijaz Bandy of CCAS (KU) for his useful suggestions also.

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