SYNOPSIS...
1.0 Introduction

Lonar Crater is an impact crater situated in the Buldana District of the Indian state Maharashtra. Latitude $19^\circ 58'45''$N, Altitude 1852 ft, the lake is 1.83 km (600 feet) in diameter and 170 meter in depth and its age is estimated to be $52000 \pm 6000$ years. It is the largest impact crater in basaltic rock and partially filled by saline water lake. Also once thought to be volcanic origin. Lonar crater is now recognized as an impact crater created by the hypervelocity impact comet or meteorite.

2.0 Review of Literature

International status

Impact craters are also ideal locations for preserving the geologic record of planet. On Earth and Mars, craters have served as depositional basins for sediment, which in turn can preserve evidence of climatic records and potential biotic activity (Keith Milam, 2003).

Maloof (2007) have studied on Lonar crater and conclude that the lake is an excellent study of impact crater formation and deformation, shock magnetization, and fluidized ejecta.

Martel (1997) have studied on Arizona, Meteor Crater and stated that the impact crater are found on the moon, all the terrestrial planets, asteroids, and most moon of the outer planets. They are compelling evidence that impact cratering (Collision of solid objects) was a dominated and widespread geologic early solar system.

Eugene Gurov (2007) have studied on structure and morphology of Russian El'gygytgyn impact crater and observed that the inner basin about 15 km in diameter, uplifted rim about 18 km in diameter, rim height is about 180 m above the lake level and 140 m above the surrounding area.

National Status

Sen and Sabale (2008) studied on the geology and origin of Lonar Crater and observe that the impact origin of Lonar crater include presence of cogenetic glass-be glass breccia (suevite) and other breccia (fragmental breccia) in the ejecta blanket that surrounds the crater, presence of paleosol below the ejecta, absence of any lava channel/tube emanating from the crater and the lack of any other volcanogenic deposit in and around the crater.
Siddiqi (2008) studied on limnology of Lonar crater and observe that pH, DO, Total Hardness, Cl, Mg, Na, K, S, PO$_4$, NO$_2$, and stated that the Lonar Lake has extreme hyper-alkaline habitat.

Dabhade et al., (2006) studied on the Lonar crater and observe that the 20 species of avian fauna. In Limnological study pH, DO, Total Hardness, Cl, Mg, Na, K, was observed.

Satyanarayana et al., (2008) studied on the limnology of Lonar Lake and observed that cynophyceae group was the dominant among the algae community with percentage composition of 98.8 to 100% at different sampling locations.

### 3.0 Materials and Methods

#### 3.01 Physicochemical Parameters

Physicochemical parameter such as: Atmospheric Temperature, Water Temperature, DO, Total solids (TDS and TSS), Total alkalinity, Phosphate, Nitrate, Calcium, Magnesium, Sulphate, Chloride, Sodium, Potassium, Electric Conductivity, Turbidity, Salinity these parameters were analyzed in the laboratory by using the standard methods suggested by APHA (1985).

#### 3.02 Planktons

In planktons, Phytoplankton and Zooplankton were collected seasonally and phytoplankton preserved in Lugals solution and zooplankton in 4% formalin. The algae were identified up to the lowest level by direct microscopic observation with the help of different identification keys (palmer 1980 and Prescott, 1969 Lee et al., 1985, Russo et al., 2008) and identification of zooplanktons species was done using standards literature (Koste W 1978).

#### 3.03 Productivity and Eutrophication

Productivity was estimated by standards method suggested by APHA, (1889), Michael, (1984), Trivedy and Goel (1987). According to Weber (1907) Eutrophic water is nutrient rich water and oligotrophic water is nutrient poor. Nitrates and phosphates are better indicator of eutrophication and host of workers Prescott (1948) and George (1962) have emphasized the role of nitrate and phosphate content in the formation of water bloom. In present study nitrate and phosphate were analyzed in the laboratory by using...
the standard methods suggested by APHA (1985), Trivedy and Goel (1887) and Kodarkar (1992).

3.04 Soil Analysis

The soil analysis parameter such as pH, Organic matter, Nitrogen and Phosphorus were analyzed in the laboratory by using the standard methods suggested by APHA (1985), Trivedy and Goel (1887). In heavy metal Copper, Iron, Zinc, Manganese, Cadmium and Lead were analyzed by Atomic Absorption Spectrometer (AAS) Elmaci et al. (2007), Singh et al. (2011). Similarly samples were also analyzed by IR spectroscopy.

3.05 Biodiversity

Insect fauna

The insect fauna were observed in around the crater by using transect method. Five lines transects were setup, approximately 500m long and 10m wide. The transect lines were walked at a constant pace for approximately half an hour. In Transect were walked from 7.00 am to 11.00 am, when insect are most active. Insects were observed and identified by the guidelines of Gunathilagaraj et al., (1998), Kunte (2000). The spot observation was followed by photography and rarely the fauna were collected from site for their identification and after the observation the insect were released in the environment.

Avian fauna

The observation was carried out for 5 h a day from 6:30 to 10:00 am in the morning and from 4:30 to 6:00 pm in the afternoon, when the activities of birds were prominent. Species were recorded using direct observation. Photographs and videos were taken to justify the species type for those species which were difficult to identify Jones (1998). Some inconspicuous bird species were also identified based on their calls. The song and calls records of Chappuis (2000), Roche (1996)

Amphibian fauna

The observations were carried out in day time. The fauna were recorded using direct observation and Photographs were taken to justify the species. For identification of the amphibian species, using standard literature Boulenger (1920), Chanda (1994), Dubois and Ohler (2000), Ao et al (2003), Dutta (1977).
Reptilian fauna

The study areas were observed from 7:00 am to 12:00am. It was recorded that the lizards come out in the early morning and late afternoon between 4:00 to 6:00pm. Species were recorded using direct observation and Photography was taken to justify the species. Identification of lizard was made using Minton guidelines (1966).

Mammalian fauna

Species were recorded using direct observation and Photography was taken to justify the species.

3.06 Microbial diversity in water

Water samples were directly collected in sterile bottles from different sites. Enrichment of water samples was carried out by in various growth liquid media, such as Horikoshi I, Horikoshi II (Horikoshi K 1991) and Nutrient broth incubated at 37°C on rotary shaker (120 rpm) for 24 hrs. After enrichment, the samples were streaked on agar plates and incubate at 37°C for 24 hrs. (Horikoshi 1999) Identification of bacterial strain was done by 16S rRNA sequencing (ARI, Pune).

3.07 Microbial diversity in Soil

Soil sample was collected from bank of lake in sterile polythene bags. The different dilutions were prepared of the soil from 10⁻¹ to 10⁻¹⁰ by serial dilution method. The prepared sample was streaked on selective medium such as Horikoshi I and Horikoshi II (Horikoshi K 1991). The plates were incubating at 37 0C for 24 hrs. The obtained growth on plate was collected and used for 16S rRNA sequencing for its complete identification (ARI, Pune).

3.08 Molecular study of Biotopes

In the molecular study of biotope, we have collected dead Millipede in the crater and preserved from 100% ethanol. The preserved sample used for 16S rRNA sequencing for its complete identification with the help of Wizard Genomic DNA. Wizard Purification Kit from Promega.

3.09 Biochemical Analysis of Spirulina

In the biochemical analysis of Spirulina, Protein was estimated by Lowery method describe by Oliver Lowry (1951). Carbohydrate was estimated by using Anthron
method described by Seifer et al., (1950). Lipid was estimated by Chloroform Methanol Method described by Raymont et al., (1994).

4.0 Result and Discussion

In physicochemical parameter, Atmospheric temperature was recorded average range 22 to 42 °C, at station A, B and C in (2009-10) and 18 to 40 °C at station A, B and C in (2010-11). The water temperature average values ranges 18 to 40 °C at station A, B and C in (2009-10) and 16 to 38 °C at station A, B and C in (2010-11). The pH values were ranges 9.0 to 10.9 at station A, B and C in (2009-10). 9.0 to 10.9 at station A, B and C in (2010-11). The DO ranges 1.0 to 6.2 mg/l at station A, B and C in (2009-2010) and 1.2 to 6.6 mg/l at station A, B and C in (2010-11). Total solids ranges from 7232 to 12900 mg/l at station A, B and C in (2009-10) and 5600 to 12448 mg/l at station A, B and C in (2010-11). Total Dissolved Solids ranges from 5212 to 10832 mg/l at station A, B and C in (2009-10) and 5996 to 10259 mg/l at station A, B and C in (2010-11). Total suspended solids ranges from 690 to 3239 mg/l at station A, B and C in (2009-10) and 730 to 2988 mg/l at station A, B and C in (2010-11). The Total alkalinity ranges from 2140 to 3802 mg/l at station A, B and C in (2009-2010) and 1804 to 3570 mg/l at station A, B and C in (2010-2011). Phosphate ranges from 1.40 to 5.10 mg/l at station A, B and C in (2009-2010) and 1.47 to 4.48 mg/l at station A, B and C in (2010-2011). The nitrate ranges from 1.0 to 14.4 mg/l at station A, B and C in (2009-2010) and 1.0 to 14.9 mg/l at station A, B and C in (2010-2011). Calcium ranges from 114 to 350 mg/l at station A, B and C in (2009-2010) and 101 to 318 mg/l at station A, B and C in (2010-2011). Magnesium ranges from 125 to 362 mg/l at station A, B and C in (2009-2010) and 111 to 329 mg/l at station A, B and C in (2010-2011). Sulphate ranges from 87 to 142 mg/l at station A, B and C in (2009-2010) and 82 to 163 mg/l at station A, B and C in (2010-2011). Chloride ranges from 2402 to 4387 mg/l at station A, B and C in (2009-2010) and 2167 to 4198 mg/l at station A, B and C in (2010-2011). Sodium ranges from 2622 to 4052 mg/l at station A, B and C in (2009-2010) and 2048 to 3272 mg/l at station A, B and C in (2009-2010). Potassium ranges from 13.0 to 23.6 at station A, B and C in (2009-2010) and 20.3 to 26.9 mg/l at station A, B and C in (2010-2011). Electric Conductivity ranges from 16389 to 24840 μs cm⁻¹ at station A, B and C in (2009-2010).
and 14742 to 22559 μs cm⁻¹ at station A, B and C in (2010-2011). Turbidity ranges from 59 to 281 NTU at station A, B and C in (2009-2010) and 65 to 344 NTU at station A, B and C in (2010-2011). In heavy metal of water, average Copper ranges from 1.12 to 1.65 mg/l at station A in both year (2009-11) and 0.60 to 1.20 at station B in both years (2009-11). The average values of Zinc ranges from 0.48 to 0.91 mg/l at station A in both years (2009-11) and 0.30 to 0.70 mg/l at station B in both years (2009-11). The average value of Iron ranges from 0.21 to 0.64 mg/l at station A in both years (2009-11) and 0.12 to 0.48 mg/l at station B in both years (2009-11). The average value of Lead ranges from 1.40 to 1.79 mg/l at station A in both years (2009-11) and 1.07 to 1.32 mg/l at station B in both years (2009-11). The average value of Cadmium ranges from 1.0 to 1.59 mg/l at station A in both year (2009-11) and 0.80 to 1.31 mg/l at station B in both years (2009-11).

In the present investigation the recorded algal species from the family cyanophyceae were observed under the microscope and identified by two species i.e. *Spirulina platensis* and *Spirulina maxima*. *Spirulina platensis* population density average ranges from station A, B and C was 1370 to 3005 org/ml in (2009-11) and *Spirulina maxima* ranges from 900 to 1898 org/ml. In the present investigation the recorded zooplankton species from the family Brachionidae were observed under the microscope and identified by 5 species i.e. *Brachionus plicatilis*, *Brachionus rotundiformis*, *Brachionus angularis*, *Brachionus rubens* and *B. calyciformis*. Population density was measured by Sedgwick rafter cell and lackeys drops method. *Brachionus plicatilis* average ranges from station A, B and C was 10 to 148 org/100 ml in (2009-11), *Brachionus rotundiformis* average ranges from station A, B and C was 16 to 90 org/100ml in (2009-11). *Brachionus angularis* average ranges from station A, B and C was 22 to 165 org/100ml in (2009-11). *Brachionus rubens* average ranges from station A, B and C was 14 to 58 org/100ml in (2009-11). *B. calyciformis* average ranges from station A, B and C was 26 to 160 org/100ml in (2009-11).

In the present study recorded primary productivity. The GPP ranges from 0.684 to 2.110 g C/m³/day, NPP ranges from 0.206 to 1.95 g C/m³/day and Community respiration ranges from 0.078 to 0.618 g C/m³/day at station A, B and C in (2009-10) and GPP...
ranges from 0.648 to 1.784 g C/m³/day, NPP ranges from 0.321 to 1.296 g C/m³/day and Community respiration ranges from 0.160 to 0.825 g C/m³/day.

In the present study recorded eutrophication by the concentration of phosphate and nitrate. Phosphate ranges from 1.40 to 5.10 mg/l at station A, B and C in (2009-2010) and 1.47 to 4.48 mg/l at station A, B and C in (2010-2011). The nitrate ranges from 1.0 to 14.4 mg/l at station A, B and C in (2009-2010) and 1.0 to 14.9 mg/l at station A, B and C in (2010-2011).

In chemical analysis soil, pH ranges from 8.5 to 10.4 at station A and 7.2 to 9.4 at station B in both years (2009-11). The organic matter ranges from 3.74 to 5.40 % at station A and 3.0 4.60 % at station B in both years (2009-11). Nitrogen ranges from 2.40 to 3.86 mg/l at station A and 1.22 to 1.92 mg/l at station B in both years (2009-11). Phosphorus ranges from 11.20 to 12.40 mg/ at station A and 5.75 to 6.80 mg/l at station B in both years (2009-11). In Heavy Metal, The average values of copper ranges from 1.20 to 1.78 mg/l at Station A and 0.81 to 1.10 mg/l at station B in both years (2009-11). The average values of Iron ranges from 0.78 to 1.13 mg/l at station A and 0.39 to 0.65 mg/l at station B in both years (2009-11). Zinc ranges from 0.90 to 1.48 mg/l at station A and 0.48 to 0.84 mg/l at station B in both years (2009-11). Manganese ranges from 0.84 to 1.32 mg/l at station A and 0.23 to 0.71 mg/l station B in both years (2009-11). Cadmium ranges from 0.81 to 1.21 mg/l at station A and 0.49 to 82 mg/l at station B in both years (2009-11). Lead ranges from 1.10 to 1.68 mg/l at station A and 0.76 to 1.02 mg/l at station B in both years (2009-11).

In the present study recorded insect order Lepidoptera, Odonata, and Orthoptera. In Lepidoptera 15 species observed and identified 13 species, 2 species unidentified. The identified such as *Papilo polytes, Cepora nerissa, Ixias pyrene, Calotis etrida, Catopsilia Pomona, Terias hecabe, Terias laeta, Junonia hierta, Hypolimnas bolina, Danaus chrysippus, Danaus chrysippus, Danaus genutia, Triumala limniace and Euploea core*. In Order Odonata, 3 species observed but 2 were identified and 1 unidentified. The 2 identified species such as Orthetrum pruinosum neglectum and Orthetrum Sabina Sabina. In order Orthoptera, 5 species observed and identified such as Gryllus, Green bush cricket, Patanga Japonica, Locusta migratoria, Melanoplus bivittatus.
In present study recorded 22 avian species were observed and 17 were identified and 5 species unidentified. The 17 identified species such as Accipiter badius, Anas acuta, Anas poecilrhyncha, Anas quequedula, Athena brama, Copsychus saularis Coracias benghalensis, Eudynamys scolopacea, Halcyon smyrnensis, Himantopus himantopus, Meropus orientalis, Pavo cristatus, psittacula krameri, saxicoloides fulicata, Tadorna ferruginea, Turdoides caudatus, vanellus indicus.

In present study recorded Amphibian order Anura 3 species were identified. 1 species were Bufonidae family and 2 species were Ranidae family. The 3 identified species such as Bufo melanostictus, Fejervarya limnocharis and Hoplobatrachus tigerinus.

In present study recorded 3 Reptile families i.e. Agamidae, Colubridae and Elapidae. The two identified species of Agamidae were Sitana ponticeriana Cuvier and Calotes versicolor. In Colubridae have 1 species observed, ptyas mucosus (Dhaman). In Elapidae family one species of Indian Poisonous snake Naja naja.

In present study 3 species recorded in mammals i.e. Rousettus leschenaulti, Semnopithecus entellus and Funambulus palmarum roberstoni.

In the present investigation we have isolated four Microbial colonies on water. The obtained bacterial strain has been identified by the 16s rRNA Method with the help of Agarkar Research Institute Pune (ARI). The identified Microbial strain such as, Bacillus fusiformis, Exiguobacterium auranticum, Bacillus amyloliquefaciens, Exiguobacterium mexicanum in water.

In the present investigation we have isolated five Microbial colonies in soil. The obtained bacterial strain has been identified by the 16s rRNA Method with the help of Agarkar Research Institute Pune (ARI). The identified Microbial strain such as, Bacillus cereus, Bacillus pumilus, Lysinibacillus sphaericus, Bacillus weihenstephanensis and Lysinibacillus xylanilyticus. Out of 9 microbes, NCBI has given accession number for 7 microbes.

The molecular study of Millipede was identified by 16S rRNA with the help Paul Herbart Barcoding Center. Aurangabad. The identified millipede was up to genus level, family spirobolidae and genus Narceus. BOLD and NCBI give accession number.
In the present investigation of Biochemical of spirulina, protein it ranges from 62%, carbohydrate – 19% and Lipid is 6% were recorded

5.0 Conclusion

Hydrobiological Status

- Water is not potable for drinking and domestic purpose according to guidelines of WHO and others.
- Water is not useful for agriculture purpose due to high salinity and chlorides.
- DO level is quite low therefore for the diversity of benthic flora and fauna is limited
- The lake is in the status of Eutrophication due to continuous adding of Nitrogen and Phosphate.
- Cl, Na, Ca, Carbonate and Bicarbonate, TS, TDS, TSS, Salinity are found on the threshold level. pH is higher than other waters.
- Heavy metals are found higher range
- Water is green colour due to the presence of large amount of microscopic algal blooms

Pollution status

- Both the aquatic and land pollutants are found in an around the crater by various pollution source such as use of agrochemicals like pesticides, insecticides, herbicides, etc.
- The faunal biodiversity specially the insect are under the stress due to application of agrochemical
- The insect is decrease by due to this pesticides and the bird fauna and amphibian fauna is also decreasing because decreasing their natural food like the insects.
- The pollution load is directly responsible for the distribution and abundance of flora and fauna.
- The entire lake come under category of eutrophication due to continuous loading of the nitrate and phosphorus by surrounding campus hence the diversity is low.

Adverse effect of eutrophication, increase biomass of planktons, increase biomass of benthic and epiphytic algae, decrease water transparency, dissolved oxygen depletion.

The biodiversity of crater is under serious threat because of the faunal diversity is decreasing day by day due to various activities such as illegal poaching, hunting and destruction of their natural habitat therefore there is an urgent need for the conservation of biodiversity the deforestation and land use chemical are the major cause for reduce biodiversity.

Ecological status

Rapid rate of deforestation is the current ecological problem of Lake System. The cutting of trees, overgrazing of animals, erosion of soil and pollution load such as due to local domestic sewage, accumulation of non degradable waste in the crater.

6.0 Recommendation for Conservation of Lake

1) Construction free zone in around the crater.
2) Declaration of Silent zone.
3) Use of sewage treatment plants around the crater
4) Promotion of Organic farming around the crater.
5) Tourism and their codes
6) Local NGOs and their role
7) Wild life act and implementation
8) Metrological monitoring
9) Sponsors for Conservations
10) Media and information
11) Government and policies