systematics like Rb-Sr, Sm-Nd, U-Pb- Th, K-Ar, Ar-Ar. In the 3rd lecture he elucidated the principles of mass spectromet!y. In lecture-4 Dr. Sandeep Singh talked on basics of Rb-Sr systematics: whole rock and mineral dating. He discussed the properties of Rb, Sr and Rb-Sr decay principles and plotting of isochron and measuring of an errorchron. Knowledge of mineral and whole rock dating was also shared by him. He stressed on "not to be dishonest in omitting certain points from the isochron purposely". Prof. RM. Manickavasagam (IIT Roorkee), introduced the subject of ion chromatography in a lucid manner. He explained the geochemistry involved in sample preparation and the chemistry behind the ion chromatography. He talked about ion exchange principles, resin structure and its properties. In lecture-6, Dr. Sandeep Singh introduced participants about various types of mass spectrometers like TIMS, SIMS, ICP-MS, LA-ICP-MS, MC-ICP-MS, AMS, GS-MS. He gave a full demonstration of Thermal Ionization Mass Spectrometer (TIMS) which has been installed in IIC, IIT Roorkee. Rb-Sr dating was discussed by Dr. Sandeep Singh in the 7th lecture. Prof. A. K. Choudhary in the 8th lecture gave an introduction to strontium isotopes in petrogenesis. He talked about BABI, lunar chronology and behavior of Sr isotope in various types of rocks.

Dr. Sunil Kumar Singh (PRL, Ahmedabad) talked in the 9th lecture about the Sr isotopic analysis in water system. He gave an idea that Sr in water system has been used to study the weathering and erosion and to understand the geochemical cycles of carbon and other elements. Dr. Sunil Bajpai (IIT Roorkee) devoted his lecture to historical geology. It was made clear that Isotope geology can also be utilised in the dating of fossils. He elaborated on the utility of Sr isotope study in deciphering the habitat and migration of various paleo-animals. It can also used for forensic science. In the 11th lecture, Dr. A.R. Vijan (KDMIPE, ONGC, Dehra Dun) told that Sr isotopes can be used extensively in dating of sedimentary rocks with certain precautions. Prof. K. Gopalan (NGRI, Hyderabad) introduced the vital part of geochronology i.e. isotopic dilution. The 12th lecture on isotopic dilution by him was extremely helpful for every type of eochronological analysis. In the 13th lecture Prof. Kailash Chandra Mittal (IIT Roorkee), explained the fundamental of electronics, instrumentation of the TIMS. The 14th lecture by Prof. A.K. Choudhary was on the new frontiers in isotopic research. He talked about microchronology and uses of Sr isotopes as tools of investigation. The last lecture was by Prof. A.K. Jain (IIT Roorkee), where the class was taken into the mysteries of Himalayan collision. There was an active interactive discussion on the closure temperature and exhumation of terrain. The exhumation history is now hotly debated as people are eager to know the relative roles of the tectonic activity vis-à-vis the weathering process.

During the course the participants were acquainted with all the steps starting from sample preparation to chemical analysis, instrument handling and data acquisition and interpretation. We started with five whole rock samples and three mineral separates and worked hard even sometimes late into the night and plotted an isochron and got a good result. At every step, Prof. Jain, Prof. Choudhary, Prof. Manickavasagam and Dr. Sandeep Singh guided us. In addition to that, we were made familiar with AAS, ICP-MS and EPMA at IIC, IIT Roorkee which are helpful in studying isotope geology. The helping hand lent by Dr. Tamal Ghosh, Biswajayee A. Patra, Nikunja Bijari Singha and Chandramouli Kulashreshta made the programme even more beneficial.

In the valedictory function Dr. Ch. Shivaji (DST, New Delhi) congratulated all the participant and the team behind the contact programme for its grand success and wished the best of luck for future.

IIT Roorkee
Email:sidas_28@yahoo.com

Iswar Chandra Das, K.V.S.S. Krishna, K.R. Praveen, Dwijesh Ray, K.R. Baiju, Jayant Ku. Jena, Tapos Ku. Goswamy

FAST DECLINE OF WATER LEVELS IN URBAN TIRUPATI, CHITTOOR DISTRICT, ANDHRA PRADESH

For all the fairly good amount of rainfall in India, large amount of it is lost through runoff in the absence of sufficient sites for storage and impounding. There is thus an imbalance between recharge and groundwater development in many parts of the country. Tirupati, Madanapalle and Punganur municipalities are located in Chittoor district of drought-prone Rayalaseema region of Andhra Pradesh. Geologically, these areas are characterised by granites and dyke rocks of Archaean age and are overlain by recent alluvium. The average annual rainfall observed in the Chittoor district is around 954 mm. The existing borewell data in the southern part of Tirupati indicates an upper layer of soil and clay down to an average depth of 2 m, followed by highly weathered and unconsolidated zone down to a depth of 25 m giving place to hard granites at depth. The hard granite has water-bearing fractures at 30-40 m and 50-60 m depths. An ephemeral Swamamukhi river (no flow since many years due to upstream Kalyani Dam) passes south of Tirupati and part of it encroached by land grabbers for agricultural purpose. The groundwater storage is declining fast with no avenue of replenishment. In the context of perpetual crises, Tirupati Municipality has been contemplating on importing-surface water from the Telugu ganga project to cater to the needs of domestic water supply particularly in summer season.

The Tirupati Township with a population of 2.85 lakhs has to bear the burden of a floating population of 40,000 on average per day to Tirumala (famous pilgrim centre) for pilgrimage, whose demands for additional water requirements have aggravated the problem of water scarcity. The population size and the growth of commercial activities in urban Tirupati are increasing at an alarming rate due to the migration of people from rural areas. Due to the rapid urbanization, the existing water bodies (tanks) in Tirupati urban area have disappeared and converted into commercial complexes. These tanks, largely constructed by local leadership, have in the recent times become the victims of State governments, which indulged in converting them into concrete jungles, due to the fast urbanization. This has resulted to rapid decline in water table. Tirupati had more than 40 irrigation and percolation tanks in and around the town before 1970. But urbanization has taken its toll with the disappearance of about 16 tanks.

The Tirupati Urban Development Authority (TUDA) has been the main culprit for converting the tanks into urban house sites and commercial complexes for its sustenance. The municipality of Tirupati has had its share when it constructed the vegetable market in one of the dried up tanks. That the government has itself no concern for protecting the tanks in the neighborhood of Tirupati is vindicated by the fact the TUDA, a statutory body of the government has converted the Rayalacheruvu and Avilala tanks into housing colonies, Tataiahgunta into an office complex and main vegetable market. Upparapalem tank has met with a similar fate and has been converted into the Autonagar and other commercial complexes by the government agencies. Presently Tirumala Tirupati Devesthanam (TTD), a religious body centering on the world famous God of Venkateswara on Tirumala Hills, too is trying to encroach on the Peruru tank for providing employees with house sites (State Government has issued G.O, but case is pending in the Supreme Court).

Declining Water Levels

Hydrographs of observation wells, monitored by the A.P. State Groundwater Department, in municipal limits of Tirupati, Madanapalli and Punganur of Chittoor district, located in different topographic settings have shown general decline trend of water tables. A steep decline of water levels to 8 m and 6 m has been observed in last two years (2002-2004) in Madanapalle and Punganur, respectively. A piezometer in the premises of Sri Venkateswara University, Tirupati urban area, points to a continuous decline in water levels from 10 to 24.2 m in the last five years period (1999-2004). The bar diagram of year-wise water table decline of Tirupati, Madanapalle and Punganur is shown in Fig.1. Hydrogeological studies of this study area indicates that the weathered zone tapped by dug wells have gone dry. The continuous declining of water levels, as evident from the hydrographs, reveals that the discharges are more than the recharge of groundwater. To reverse this situation, it is imperative that rainwater harvesting and artificial recharge become mandatory in these areas. The involvement of households and local community is necessary to achieve this objective.

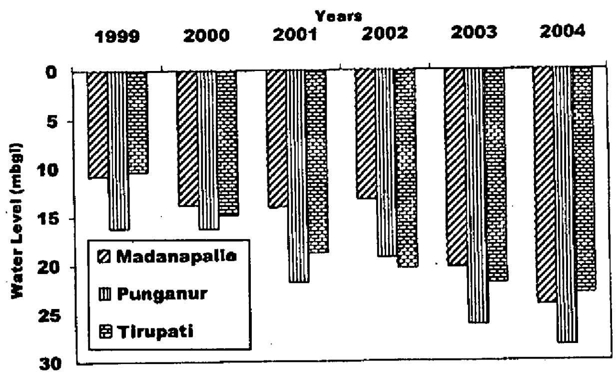

Fig.1. Year-wise water level decline of Tirupati, Madanpalle and Punganuru.

Rainwater Harvesting

Rainwater harvesting is based on the principle of capturing and storing the rainwater, when and where it falls, by different methods for infiltration and percolation into underground to augment the groundwater levels. This is necessitated in the context of high run off occurring due to flash floods in a short duration, especially during low rainfall years. Rainwater harvesting has helped many areas in improved groundwater availability. Suitable artificial recharge structures for groundwater development in Tirupati area are suggested in Table 1.

Table 1. Harvesting Structures to Augment Groundwater Levels in Tirupati Area

Lithology	Topography	Rainwater Harvesting Structure Recommended
Hard rock with soil cover	Highly undulating/ hill slopes	Gully plugging
Boulders with gravel and clay	Piedmont (along the foot hills)	Small basins/ ponds/ pits
Alluvium on hard rock	Plain area/gently undulating tanks	Check dams, percolation and subsurface dams

Since the water levels are continuously declining and fast urbanization which is affecting the water bodies (tanks) in Tirupati area, rain water harvesting structures to augment groundwater resources are very much needed. top rainwater harvesting (RTRH) in the Tirupati town should be strictly implemented. Strict legislation should be enforced to stop further development of ground-water structures in and around Tirupati town. Existing water bodies (tanks) in Tirupati surroundings should be well maintained and these should not be converted into commercial complexes. A large number of dried-up wells as consequence of over exploitation in Tiruapti urban area should be converted into recharge wells by diverting the rooftop and flood runoff into the wells. Gully plugging across the minor streams flowing down the Tirumala foothill (north side of Tirupati) slopes needs to be undertaken. Contour trenching and bunding along the Tirumala foothill slopes is required to augment the soil moisture and to prevent the soil erosion. Number of check dams and subsurface dams across the minor and major streams flowing in and around the Tirupati town should also be constructed on plain areas.

Hydrogeology Lab
Department of Geology
Banaras Hindu University
Varanasi - 221 005
***Email:** rajunj7@yahoo.com*
N. JANARDHANA RAJU

SHOCK BASALTIC GLASSES FROM LONAR LAKE, MAHARASHTRA: A POTENTIAL NATURAL ANALOGUE OF NUCLEAR WASTE GLASSES

One of the most critical issues in nuclear waste management is the extrapolation of material and system behavior from short-term laboratory experiments, typically on the order of two-three years to thousands of years. Natural rhyolitic and basaltic glasses serve as potential natural analogues of nuclear waste glasses for providing insight on the long term performance assessment of these High-level radioactive waste forms over thousands of years in a deep geological repository. In spite of compositional variation, a remarkable phenomenal similarity exists among these glasses in terms of alteration mechanism, rates and products when subjected to alteration by both fresh as well as marine waters. In this note, the geochemistry of shock glasses from world famous impact crater of Lonar Lake, Buldana district, Maharashtra is evaluated to assess its suitability for use as a natural analogue of waste glasses.

Introduction

The geological disposal of nuclear wastes involves immobilizing the waste in suitable matrix, mostly glass placed in metallic canisters, and disposing them at a depth of 600-900 m in suitable host rocks. Additional protective layers of swelling clays and clay and sand mixture are proposed to be inserted between waste canisters and the rock. The waste form, clay and sand-clay mixtures are popularly known as engineered barriers. Once a repository is back filled and closed, the wastes and barriers are expected to require no further active management. Studies have indicated that engineered barriers will eventually give way by maximum after 1000 years or so and waste will be in contact with groundwater. In this situation the only mechanism whereby radionuclides can escape to biosphere is through transport by migrating groundwater. The inserted clay layers are expected to limit the timing and rate of any outward migration of radionuclides leached from the waste. One of the most critical aspects of nuclear waste management is the extrapolation of materials and systems behavior from short-term experiments, typically of the order of one year to over very long time periods. Usually a time frame of the order of tens of thousands years has been under consideration over which safety offered by this mode of disposal is considered adequate. The justification for the selection of this time period has emerged mainly because the ingestion