Editorial

I wish JIGU readers, authors, editorial board members, well wishers and IGU management "A Happy and Prosperous New Year". I have included two interesting topics as the core of this issue`s editorial. The first one is purely scientific, where as the second covers an important societal problem. I welcome your constructive suggestions in better structuring of future editorials.

We Need a New Definition for "Magma"

Any earth scientist carrying research on structure and dynamics of crust and sub crustal lithosphere, genesis of volcanic activity, formation of kimberlite pipes, plumes/hot spots and assembly- break up and reassembly of Super continents invariably talk about presence of shallow and deep Magma/ Magma chambers .In doing so many a time the definition of Magma is subconsciously misused. To focus on this aspect a good study has been carried out by a group of scientists. I detail below their apt handling of the topic through easily understandable presentation.

Magma is a fundamental constituent of the Earth. Issues as diverse as volcanic hazard assessment and planetary evolution studies rely on knowledge of magma's properties, origin, evolution, and significance. Thus, the definition of "magma" should be simple and universally agreed upon, but the term means fundamentally different things to different people. This inconsistency has led to miscommunication between petrologists, geophysicists, the press, and the public, making the "confused or disordered" definition of the word unintentionally appropriate. It is time to agree on a clearer geologic definition of "magma". Magma should mean material that is capable of moving within the Earth and onto its surface. To the public, magma is the stuff of lava—hot, glowing red liquid that flows out of volcanoes—and such lava is unquestionably magma that has reached the surface. The point of contention is whether partially molten rock that resides below the surface and is too crystalline to flow should also be called magma. Because this distinction is critical when geologists communicate about magma, especially to the press and public, Glazner et al (2016) contend that highly crystalline immobile material should not be called "magma." Rather, magma should mean material that is capable of moving within the Earth and onto its surface. "Magma" is commonly used to mean any rock that is at least a little bit molten. Whether rock that contains a small percentage of partial melt should be called magma is debatable. Indeed, use of the word "magma" to refer both to material that can flow across the Earth's surface and to a largely solid volume that contains a small fraction of melt is akin to using the same word to refer to a river and to an aquifer. To do so ignores and obscures fundamental differences, and broad usage of "magma" is clearly causing such conceptual problems.

A critical control on mobility in a crystal-liquid mixture is the volume ratio of crystals to liquid; the apparent viscosity of a mixture (the ratio of how much shear stress is applied to the rate at which the material deforms) depends upon the proportion of particles suspended in it. For a low percentage of solid particles, less than 20% by volume, for example, the particles are sufficiently dispersed that they scarcely interact during flow. During cooling, crystals grow onto one another and interlock to produce a welded framework that is even stronger than one produced by nonreactive particles such as pebbles in water. Such a material can only flow by processes such as crystal plasticity and solution-reprecipitation, at rates dramatically slower than those at which even highly viscous silica-rich melts can flow. Collecting melt from such a material is a slow process.

This fundamental difference in deformation and flow (rheology) between partially molten rock that is melt rich (more than about 50% melt by volume) and its melt-poor counterpart (less than about 50%) is reason to give the two materials different names. Here we suggest that the term "magma" be reserved for melt-rich materials that can flow as fluids on timescales consonant with volcanic eruptions. We suggest that more crystal-rich and largely immobile partially molten rock be referred to by another name such as "crystal mush" or "rigid sponge". By this definition, highly viscous materials such as water-poor rhyolite lavas, with viscosities that can reach 10^{10} pascal seconds or greater, are magma, whereas

highly crystal rich materials are not. The former can ascend to the Earth's surface sufficiently rapidly to be erupted, whereas the latter cannot. This is consistent with the general observation that volcanic rocks with more than about 50% crystals by volume are rare.

For the press, the public and even Earth scientists who do not specialize in magmatic systems, "magma" conjures up dramatic images of lava flowing down hillsides. Using the same term to describe large rock volumes that contain small melt fractions as well as large bodies of mobile magma can engender such mistaken perceptions as a sea of potentially eruptible magma underneath Yellowstone of USA.

To solve this, intellectual debate is necessary. In the November, 2016 issue of JIGU I suggested a proper debate amongst learned specialists in fixing up onset of Anthropocene as an Epoch. Similarly it is essential to start a conversation to have a more appropriate definition of "magma". To start with as a starting point the following definition as suggested by Glazner et al (2016) can be used as a more viable definition.

Magma: naturally occurring, fully or partially molten rock material generated within a planetary body, consisting of melt with or without crystals and gas bubbles and containing a high enough proportion of melt to be capable of intrusion and extrusion.

This proposed definition naturally reflects our particular scientific perspective and concerns. It is opined by Glazner et al that the proposed definition will stimulate a broad-based discussion that will yield a consensus definition.

Citation: Glazner, A. F., J. M. Bartley, and D. S. Coleman (2016), We need a new definition for magma, Eos, 97, doi:10.1029/2016EO059741.

Good health of Surface water bodies, a basic necessity for sustenance of life

With increased irregularity and absence of a set pattern of precipitation during monsoon, it has become a necessity to store rain water as and when rains occur for sustenance of our very existence on this planet; the only planet as of now known to have life. Storage of water has been practiced since hundreds of years through surface water bodies; lakes, tanks and ponds. Unfortunately, due to the unchecked growth of population human needs have terribly increased and man has over exploited our natural resources. He has also produced material that helped him to ease day to day activities (essential to lead a physically less stressed life).In this process he has created mounds of waste, which polluted significantly our life saving water, air and food. In addition to pollution, improper maintenance of our water storage facilities led to insufficient availability of quality water for drinking, irrigation and industrial purposes. A time has come for a radical change in our outlook. We cannot afford to postpone rehabilitation and revitalization of our surface water bodies. In the recent times both the central and state governments have taken up rehabilitation measures, through mega projects spending thousands of crores of rupees. Since these initiatives are time bound, some execution lapses creep in.

After viewing at the type of rehabilitation measures presently in vogue (in different parts of our country, including the newly formed Telangana State), experts have carried out area specific monitoring studies and arrived at the conclusion that "de-silting" of the surface water bodies is more dangerous and hazardous as it disturbs the original lake/ tank/ pond bed and increases losses through heavy seepage. While this could be true where significant number of fractures and fissures exist it may help better storage in areas that are devoid of fractures. As such it is essential to go through the satellite imageries of a lake or pond, to initiate appropriate rehabilitation measures. Sediments from agricultural areas often contain high levels of nutrients. These can be carried by streams and deposited in the still water areas of lakes. Nutrient-enriched sediments can be trapped before they reach the lakes. In the Indian Lakes, there are several channels which act as natural sediment deposition areas. Sediments accumulated there can be dredged out periodically and returned to the land as fill or fertilizer. To avoid random and disorganised removal of sediments it is essential to identify all the sites which contain nutrient-enriched sediments. These sites should have easy access for heavy equipment. Such a provision helps in not building additional structures.

Now a days, desilting is becoming a major component of any Lake Conservation Project. The basic reasons

given for necessity of desilting are - increasing the storage capacity and checking eutrophication conditions (the process of physical, chemical, and biological changes ("aging") associated with nutrient, organic matter, and silt enrichment of a lake). It is not practicable to reverse the slow process of silting in the bed of lakes through which only silt can be removed. What we are doing in the name of 'desilting' is practically 'digging' or 'excavation' of lake bed. By so called desilting, the original lake bed is disturbed, which has far reaching adverse effects on the performance of the lake. Most visible effect is the increase in percolation rate resulting in heavy seepage losses through the lake bed as observed after massive desilting at Pushkar lake in 2009. Increasing storage capacity by digging lake bed is the most costly proposal when compared to other alternatives and therefore needs study of alternatives as well as detailed hydrological investigations considering available yield, existing storage capacity, down-stream needs, etc. As overflowing of a lake is necessary to keep the river alive in the downstream and to flush out the static water of the lake, if a lake does not overflow at least once in four years on an average, there is no need to increase the storage capacity. Instead of desilting, the long term solution is to treat the catchment area so that silt load in the incoming flow is permanently reduced. This can be done by contour bunding, check dams, massive plantation, etc. (**P.S**: Their location and quality in execution, however, is paramount to ensure the benefits) which will be less costly and will have far reaching positive effects of permanent nature. Desilting, if not done in a planned way, creates isolated pits of considerable size in the submergence area, which may have lower bottom levels than the main storage. Because of this isolation, water collected in these pits never reach to the main storage, it only seeps or evaporates. Thus, desilting said to be carried out for increasing storage capacity, practically reduces the actual utilizable storage in most of the cases. Removing surface soil to check eutrophication, is like giving treatment for symptoms instead of the disease. Unless we check the inflow of untreated sewage in lakes, it is not possible to reduce the nitrate or phosphate contents. Therefore, it is better to invest funds on checking of sewage inflow than on removing surface soil for the purpose so as to have permanent solution of the problem.

Sources:

1) (http://www.solitudelakemanagement.com/blog/improving-pond-water-quality-through-phosphorus-reduction#sthash.Iub78F9r.dpuf**).**

2) P.Cullen; Hydrobiologia; December 1988, Volume 170, Issue 1, pp 321-336 (http://link.springer.com/article/10.1007/BF00024912**).**

3) (http://www.indiawaterportal.org/articles/conservation-lakes-myths-and-realities-desilting).

In this issue:

I am happy to mention that JIGU is catering to the needs of students and young researchers by encouraging them to contribute manuscripts covering their research pursuits. The support extended by young researchers and their guides is very encouraging. This positive development has made us to forget the hardships in maintaining the quality of the journal, as the basic aim of JIGU in providing a viable medium to young researchers is realised. I thank the young authors and experienced experts who carry out constructive review for this positive development.

In this issue we have 8 research articles, News at a Glance and a research note. I do hope our readers enjoy reading these well presented articles.

I earnestly solicit your co-operation, support and guidance in making JIGU a premier earth system science journal.

P.R.Reddy