

## Has earth science been ignored?

Ram S. Sharma

We celebrate Environment Day on 5 June every year to generate public awareness about our environment and to keep it pollution-free. The concern about environment and climate is universal and scientists specialized in biology, chemistry and medicine have directed their research in this direction. Departments of Environmental Sciences have been opened, without realizing that these problems are related to life, air, water and rock. We are aware that air pollution is due to smokestack emissions, vehicle exhaust, dust and aerosols from coal burning and industrial emissions. Likewise, we have become conscious of water pollution as life cannot exist without water. Air-water pollution and global warming are serious problems and humans are responsible to some extent for these problems. Society is facing scientific challenges, such as environmental protection, natural hazard reduction, waste disposal, land use, resource development, etc. But, we do not know that all these problems can be better understood if people become geo-literate or eco-geo-literate and hence people must be educated about the Earth and its water-air-solid sphere. A volcanic eruption anywhere can release greenhouse gases (GHGs), particularly CO<sub>2</sub>, into the atmosphere that may exceed the CO<sub>2</sub> emitted by all industries of the world in that duration or even in longer times. The CO<sub>2</sub> emitted into the atmosphere is dissolved in ocean water which ultimately precipitates as carbonates, thus reducing this GHG in atmosphere and oceans. Precipitation of carbonate functions as the major sink for CO<sub>2</sub>, largely balancing this gas emitted from volcanic eruptions. The two ends of CO<sub>2</sub> emission and sink are indeed the subject matter of geology or earth sciences.

If chemistry builds on physics by telling us how matter is put together, how atoms combine to make molecules and how molecules make materials around us; geology is the science where physics and chemistry are applied to the study of Earth and its processes. Astronomy is the

application of physics, chemistry and geology to the study of other planets and the stars. This shows the importance of geology or earth science as a subject. This subject accumulates events that the Earth has witnessed since its birth, about 4.54 Ga ago. The time-span is therefore in million years. We developed understanding of the origin and internal working of our planet; processes that modify our landscape and evolution of life during times of different environments. Raw materials and other natural resources sustain the needs of the society. In this respect, earth science is the only science which has direct relevance to society. However, almost all new universities in India have excluded this important department from their educational programmes. Geology, geosciences or earth science departments have been closed in many institutions. Certain topics of fundamental importance such as crystallography and mineralogy have been removed from the syllabii of the already established universities without any valid reason. How can a student understand about rocks without studying about crystals and minerals, leave aside discovering a new mineral?

The year 2008 was proclaimed as the International Year of Planet Earth (IYPE) by the United Nations General Assembly. The aim was to bring together the international knowledge base of geosciences and demonstrate new and exciting ways in which earth science can help future generations meet new challenges.

Even ability to use our vast resource of coal (which produce CO<sub>2</sub> on burning) or grow rice (which produces methane at some stage) requires geological knowledge. Reduction of GHGs, especially CO<sub>2</sub> emission was agreed upon by all nations to decrease global warming. But, global warming is about climate and weather and is a complex system not related to specific events. In this warming world, there will still be unexpectedly cold winters and summers. A single severe storm can prove that global warming is occurring. The US National Center

for Atmospheric Research detected five different factors for the increase of temperature in the Earth. These are volcanoes, sulphate aerosol pollution, solar activity, GHGs and ozone depletion. For increase of GHGs due to human activity (burning coal, oil, etc.), the UN-sponsored agreement, called Kyoto protocol was ratified by nearly all nations who agreed to decrease their CO<sub>2</sub> gas emission. Nations began to change technology and lifestyle for this treaty to be effective. But, scientists with a good geological background can argue that global warming may not be a threat to the human race. If we burn coal, it produces aerosols (atmospheric clouds of tiny particles of pollution) that would reflect heat energy back into space. Moreover, some of the carbon entering the atmosphere as CO<sub>2</sub> may result in more luxuriant plant life and more limestone deposits in the ocean. Also, if there is an increase in temperature, sea water (covering 70% earth surface) would change to water vapour which is also a GHG. So, more water vapour would produce more clouds which, in turn, would reflect sunlight away and reduce temperature. But, these arguments need a database and it becomes imperative that earth sciences should be encouraged in Indian universities. We have to build strong geosciences departments having strong and sustained leadership with the cooperation of geoscientists and field geologists. Earth science curriculum should have research/academic, developmental and awareness activities. These can be supported by workshops, poster sessions and annual meetings to collect views and opinions on recent trends in earth sciences by geoscientists of academic standing. Further, geoscientists should be encouraged to write on this subject for creating public awareness about earth science.

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Ram S. Sharma (INSA Hon. Scientist) lives at 70/36, Pratapnagar, Sector 7, Sanganeer (RHB), Jaipur 302 033, India. e-mail: sharma.r.sw@gmail.com