poor leadership; (ii) governmental apathy in monitoring output versus expenditure; (iii) poor project planning; (iv) bloated sense of importance assigned to certain aspects (e.g. the claim to be able to predict future climates on the basis of palynological studies), (v) repetitive researches (Maithy, P. K., *Curr. Sci.*, 2002, **82**, 776–777); (vi) declaration of results in anticipation of a new discovery before replicating the results (e.g. alleged find of Cretaceous palynofossils in the Early Permian Talchir Formation of Brahmini River, Orissa), (vii) lack of reading habit (absence of a well-constructed and comprehensive, easily accessible database may be the reason), and the habit to surf and browse the internet; (viii) allergy to comparative studies on modern plant communities; (ix) last but not the least, total exclusion of retired 'professional' palaeontologists from advisory, monitoring or selection procedures (according to noted statistician Calyampudi R. Rao, honoured with US President's National Medal for Science at the age of 82, 'In India, no one respects you after you retire. Even colleagues respect authority, not scholarship').

The need of the hour is to develop palaeobotany as an applied discipline (study of taxonomy and systematics is axiomatic), identifying areas of topical economic interest, to plan research strategies with teams under proven leaders and to complete the job within a fixed time period. Funding agencies need not dole out funds for projects with obscure objectives.

We suggest that the Ministry of Mines, Ministry of Science and Technology (DST), Oil and Natural Gas Corporation, and University Grants Commission constitute a working of reputed, active and retired professional palaeobotanists, palaeozoologists, coal geologists, oil prospectors and climatologists, to study the paper presented by Mukund Sharma and suggest remedial measures.

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Why neglect groundwater biology?

It is well known that groundwater is a precious resource for several vital functions such as for public, industrial and agricultural water supply. It is stored in karstic, fissured, and porous aquifers, and accounts for 97% of the world's unfrozen freshwater. On a global scale, underground aquifers provide drinking water to almost a third of the population, and irrigate 17% of the crop land to yield 40% of the food. What is, however, not known in most parts of the world is that aquifers are not merely reservoirs, but veritable ecosystems.

The dogmatic perception that the underground is an inhospitable environment to life persisted till recently. That the groundwater supports animal life came as a revelation to the public authorities and scientists in Germany, two decades ago. Subsequent investigations, mostly by Europeans, have established that the groundwater biotope or stygon is inhabited by rich and vastly diverse fauna[1]. For example, Pesce[2], while presenting a synthesis of the Italian groundwater fauna (stygofauna), recognized the following groups as dominant ones: cyclopid and harpacticoid copepods, ostracods, thermosbaenaceans, mysids, amphipods, isopods, syncarids, decapods, water mites, nematodes, gastropods, triclad turbellarians and amphipods. The sporadic groups include Bacteria, Protozoa, Rotifera, Cladocera, Archiannelida, Oligochaeta, Gastrotricha, Bivalvia and insect larvae. Hence the stygon, comprising many distinct habitats, which are more or less interdependent and/or intergrading with each other, has now come to be regarded as a promising place to look for insights into biological adaptation and speciation[3].

Stygobionts are typically small (1 mm in length when large), eyeless and colourless animals, feeding on bacteria, fungi and detritus. They have successfully adapted themselves to the dark, nutrient-poor, spatially constrained, interstitial, hypogean habitats. They have originated from their extinct/extant epigean ancestors of marine, freshwater and semiterrestrial habitats at different times and in different ways. Crustaceans such as the extant freshwater bathynellaceans have emerged from their marine ancestors as far back as the Carboniferous[4]. Similarly, many other stygobionts represent the phylogenetic relicts or the present-day witnesses of very ancient groups, which have disappeared from the epigean world.

Stygofauna play a vitally important ecological role in keeping the ground-water-bearing strata clean of organic particles brought in from the soil or surface waters[5]. They provide valuable information for assessing groundwater quality and flow, and contaminant transport[6]. Furthermore, certain ancient stygofaunal elements are of much value in the interpretations relating to the reconstruction of the earth's history[7]. Yet, very little is known about their ecology, evolutionary history, physiological and behavioural strategies, and taxocoenoses dynamics[6].

Today, increasing effects of pollution on, and overexploitation of, groundwater have become a serious threat to the stygofaunal communities. Hence scientific programmes have been launched, especially in Europe and recently in Korea, to learn more about this least known of ecosystems on earth. Stygofaunistic, distributional, and ecological work is in a well-advanced stage in several European countries. However, in India, even alpha-level taxonomy of stygofauna may be said to have not yet begun in right earnest (see Botosaneanu[1] for the few known stygofaunal records from India). Animal taxonomists in the country are yet to be convinced that the Indian freshwater stygon is a treasure house for an enchanting world of new taxa, what with its highly diversified geomorphology, hydrology, chemistry, and climate. For example, my recent preliminary work on the Indian stygofauna has brought to light the order Bathynellacea[8], which has remained unreported from South Asia; the copepod family Parastenocarididae[9] which was hitherto unknown from India, and a host of new taxa, which are yet to be described and published. The Indian stygon thus holds a huge serendipitous potential not only for taxonomists and phylogeneticists, but for ecologists, physiologists and other interested biologists as well. All in all, stygology deserves to be treated and pursued as a distinct branch of biology.

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RESEARCH NEWS

Recent concepts about heat source from the earth's core

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Heat from the interior of the earth is basic for several geological processes like plate tectonics, earthquakes, volcanism, mountain-building and more importantly, for propelling the geodynamo creating the magnetic field. The earth's heat energy is believed to arise from the decay of radioactive elements present in the crust and the mantle, from primordial heat that is still left and from the secular cooling of the liquid outer core. Terrestrial heat flow is estimated to be about 45 TW ($1 \text{ TW} = 10^{12}$ W) and of this, radioactive heat, which must have been much more in early earth times, accounts for about 30 TW presently. When the total heat flux at the surface is budgeted, it is found that it is about twice that can be produced by K, U and Th in the silicate portion of earth. The source of this excess heat is thought to arise from concentration of radioactive elements in the lower mantle. But now, experimental studies indicate that at least a part of this excess heat may be accounted by K as well as U and Th in the earth's core where, hitherto, their presence according to their conventional geochemistry, was not expected.

The 3500 km thick core lies deep in the interior of the earth, beyond the mantle zone and carries a third of the total mass of the planet, but forms hardly 14% by volume. It is liquid in its outer 2100 km (outer core) and solid for the rest of the 1400 km (inner core; Figure 1 *a*). Apart from these features regarding its structure, which is fairly well made out, quite a few other aspects of the core have remained enigmatic and not fully understood. Even though some pertinent inferences have been deduced from comparative studies on meteorites, from seismic data and through several laboratory experiments and computer simulations, answers for instance, on the age of core formation, its density deficit, source of heat, anisotropy and spin of inner core are still controversial. Compositionally, the core is supposed to be essentially iron or iron–nickel compound and the inner core of solidified iron, and according to some[1], it is nickel silicide. However, for such a composition, the density of the core is about 10% lower than it should be, a disparity that is attributed to incorporation of certain low-density elements during its formation. Though the normal geochemistry of such light elements – H, Si, O, S, K, Mg and C – forbids their presence in the core, experiments on the solubility of some of them demonstrated feasibility of O, S or alkali-metals to exist in the core[2–4].

Core formation was the first major event to take place in the earth's evolution. Current views consider that the kinetic energy of the impacting accreting bodies was sufficient to heat up the earliest earth to a partly or completely molten state, even as the accretionary phase continued[5,6]. As a result, all elements

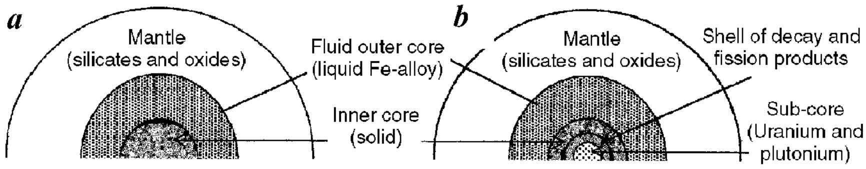

Figure 1. Two views of the core: ***a***, Traditional view with inner core consisting of solid iron or iron and nickel surrounded by a fluid outer core of iron and nickel, plus one or two light-density elements; ***b***, Georeactor model with inner core of solid nickel silicide enclosing a sub-core of uranium with decay and fission products.