

places located over Hyderabad granite pluton. These site records were cross-correlated with respect to time and magnitude of water-level change. The effects were of the same order in all the well hydrographs as that of NGRI well, indicating probable compressional effect. The tectonic map reveals trends of several mega lineaments in SE–NW and NE–SW direction. Several micro and macro fractures/lineaments do exist all through the eastern coast, extending into the central part of the subcontinent through the Hyderabad craton. The positioning of all observational sites on the tectonic map indicated that these sites are falling in NE–SW lineaments transecting to the direction of the compressional wave propagation. Studies are in progress to collect more well data for statistical analysis.

The observation and analysis of hydrographs of bore-wells with confined aquifer imprint the effect of the major Sumatra earthquake of *Mw* 9.3, though they are located about 2400 km away from the epicentre. Stress release before a major event and its influence on groundwater existing under confined to semi-confined condition, warrants further un-

derstanding. Also, morpho-structural study of an observational site is needed for better understanding of subsurface wave propagation. Suitable site selection and long-term water-level monitoring network along with seismic station will enable in understanding and precursory studies.

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Swarm cells of slime molds in sexual conjugation from sixty-five million year old sediments, Madhya Pradesh, India

Swarm cells of slime molds (Myxomycetes) in solitary or conjugating stages are reported from the Deccan intertrappean beds (Maastrichtian) of Padwar, Madhya Pradesh, India.

Sexual intercourse enhances the gene pool of the future generations, which is manifested in the innovation of new characters to cope with the external and environmental pressures. The sexual organs being delicate and the time of conjugation short-lived, it is indeed rare to get this stage in the fossil state. However, some sixty-five million year old slime molds could be recovered from the Deccan intertrappean bed at Padwar near Jabalpur, Madhya Pradesh, while in copulation.

Slime molds are generally placed under the fungi by mycologists, while zoologists place them in the order Myxogastreales, subclass Mycetozoa and phylum Protozoa^{1–4}. Though inconspicuous in

appearance, slime moulds have many stages of life cycle, comprising three types of uninucleate cells, among which one is flagellate, one multinucleate somatic phase, a resisting stage and finally a reproductive phase^{5–8}.

The slime molds were recovered from a dry dug-out well at Padwar. The well is approximately 9 m deep and has basaltic rocks at the base and top. The basal basalt is overlain by about 1.5 m thick grey-carbonaceous/lignitic shale, which is covered by more than 3 m thick volcanic ash bed. An approximately 2 m thick grey-carbonaceous shale layer is sandwiched between the ash bed and the upper basaltic rock⁹ (Figure 1). The intertrappean sediments were deposited in water bodies formed due to the obstruction of drainage channels, during the lull period of Deccan volcanism.

The palynological assemblage of the clastic sediments has been divided into a

lower *Aquilapollenites bengalensis* zone and an upper algae-dominant zone^{9,10}. The presence of *Azolla cretacea* Stanley, *Ariadnaesporites ariadnae* (Miner) Potonié, *Gabonsporites vigourouxii* Boltenhagen and *Aquilapollenites bengalensis* Baksi and Deb in the lower zone indicates a Maastrichtian age for the sediments^{11,12}. The slime molds recorded here come from the highly carbonaceous/lignitic samples (P₃–P₄) of the *A. bengalensis* zone (Figure 1). These comprise solitary swarm cells, swarm cells in sexual conjugation, spores and zygospores; however, only swarm cells are reported here. These palynomorphs were recovered by means of maceration of the samples by commercial nitric acid (40%), followed by a wash of potassium hydroxide solution (5%).

Swarm cells are biflagellate and common in the samples. Two types of swarm cells are observed. In the first type, flagella are about 200 µm long, narrow,

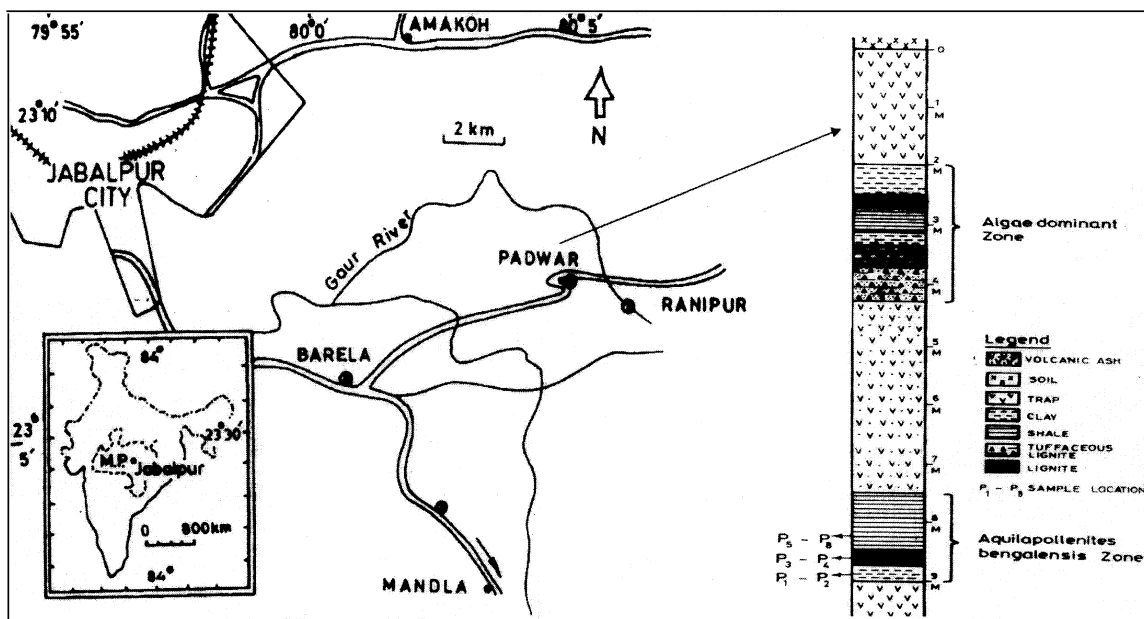


Figure 1. Locality, litholog of the well and position of the samples (after Sahni *et al.*¹⁰).

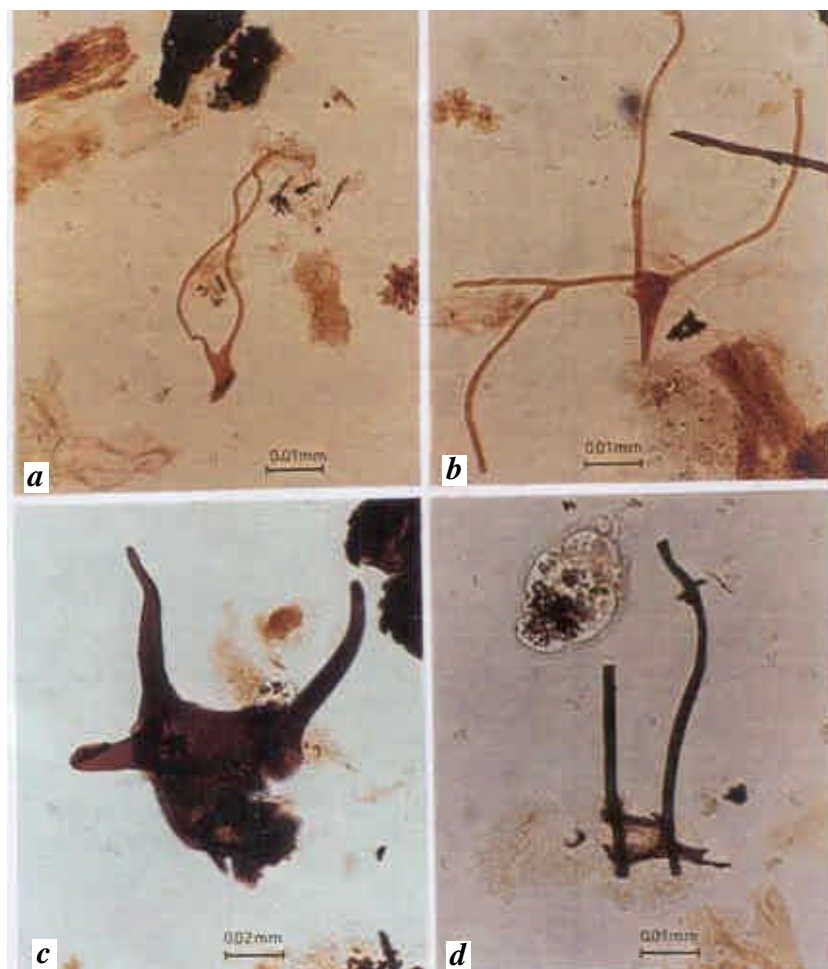


Figure 2. Swarm cells of the slime molds (Myxomycetes). *a*, Solitary swarm cell with two flagella; *b*, Two swarm cells in sexual conjugation, one showing a branched flagellum; *c*, Flagella of swarm cells lost of nascent zygospore; *d*, Flagella of two swarm cells placed in opposite direction and most of the parts lost.

lower part slightly broader, and the rest more or less uniformly broad, lateral hairs are absent, two flagella are of equal length, sometimes they are branched, may be lost in maceration; body of swarm cells is of two types, one is subcircular, 8–15 × 6–12 μm, laevigate, sporting flagella in the opposite direction. In the other type, the central body is conical, funnel-shaped, broader on one side and tapering at the other (Figure 2 a, b).

The second type has swarm cells more or less of equal size, 10–18 × 8–16 μm, the flagella are robustly built, opposite to each other, 210–320 μm in length and 5–12 μm in breadth, laevigate, without any hair at the basal part; flagella are shed gradually after zygote formation (Figure 2 c, d).

The specimens recorded here are not closely comparable to any fossil forms. Some flagellate structures recorded from the two billion year old Precambrian rocks of the Canadian Shield are devoid of such kind of body and flagella of the swarm cells^{13,14}. Flagella are formed for movement of zoospores and gametes in Myxomycetes and some members of Phycomycetes¹⁵. Flagella are basically of two types; tinsel and whiplash. In the former, lateral hairs are present at the lower part of the flagella, whereas in the latter they are absent^{16,17}.

The gametes are generally divided into four types on the basis of flagella. In Chytridiales, Blastocladiales and Monoblepharidiales, a whiplash-type of flagellum at the posterior end is observed. The tinsel-type of flagellum at the anterior end is characteristic of the Hypochitridiomycetes, whereas in the Oomycetes, one tinsel and one whiplash type of flagella are observed. Two flagella of both whiplash types are observed only in the Myxomycetes and Plasmodiophoromycetes¹⁸. In the latter, the two flagella are remarkably unequal in size, whereas in the former, the two flagella are of the same size^{19,20}. Thus in all probability, the specimens detailed here belong to Myxomycetes.

The members of this phylum are adapted to grow under varying environmental

conditions, be it the Antarctic or the desert. The Myxomycetes were reported from India since 1830 onwards, but there are no reports on the fossil form^{21–23}. They are common during the rainy season, are shade-loving and grow well under dead wood, leaf litter and cracks. The specimens recovered here were from the highly carbonaceous/lignitic shales, indicating their choice for the rotten debris. There was abundance of water as the specimens were growing in a lake. It is supposed that presence of water encourages the formation of motile swarm cells²⁴.

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