separate can be easily obtained from TL-sensitive minerals using DMD tool.

Different types and sizes of bits can be used in the Micro-Drill depending upon the mineral powder to be obtained and the complexity of intergrowth of minerals in the rock. To conclude, Dentist's Micro-Drill (preferably, coupled with a long working distance microscope) is an effective and low-cost tool to rapidly obtain pure mineral-separates (in powder form) having multifaceted applications in geological sciences, some of which are detailed above.

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DETERIORATION OF *INSITU* ROCK MASS DUE TO SPONTANEOUS COMBUSTION IN COAL MINES, MAJRI OPENCAST MINE, WCL, NAGPUR

A case of deterioration of rock mass in coal seams due to mine fires is presented here. This is a typical case wherein an old underground mine was converted to an opencast operation. Opencast mines can be mechanised to produce large quantities of coal and thereby making the operation profitable. This is the reason that some of the earlier underground mines of Coal India Limited are being converted to opencast mines. Once the open workings start, the coal formations are exposed to continuous fresh air supply. Due to the property, commonly known as spontaneous combustion, of coal, fire starts and may engulf the coal seam. This is of major concern in such operations as these fires are extremely difficult to quench e.g. Jharia Coal Field fire has a history of more than 100 years now.

Older workings or developed underground galleries pose many problems while excavating. Some of major problems faced are:

1. Spontaneous combustion (SPC) of coal seams culminating into mine fires and loss of valuable resources in addition to many other problems.
2. Excavation related problems while removing immediate overburden over such developed seams. This results in hot-hole (due to fire underground) thus rendering it difficult to place explosive in drill holes for blasting. The explosive may not perform properly if it is loaded immediately over a gallery underground due to release of gases into the underground gallery. If the drill hole has pierced into gallery, loading of explosive also becomes a nightmare. One may put excessive quantities of explosive into the hole without realising that the same is getting into the gallery below. This creates an extremely dangerous situation with formation of a bomb. The schematic diagram (Fig.1) portrays different problems encountered in the conversion to open-cast mining in coal mines.
3. Deterioration of rock mass around the workings may

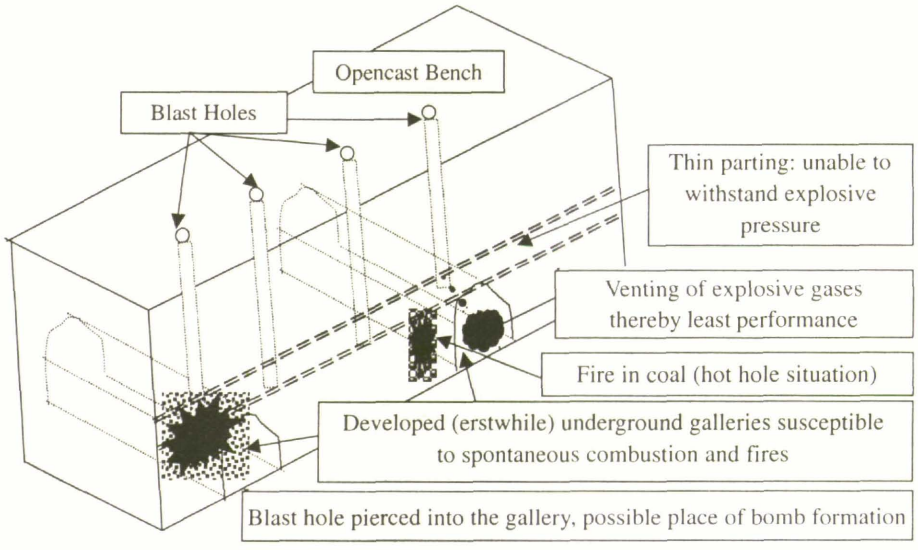

Fig.1. Schematic diagram showing problems in underground to opencast mine conversion

be another important aspect and is the basic premise of this note. The same is explained as under with an example of an opencast mine (previously underground) of Coal India Limited. The rock mass is subjected to great stress once underlying coal burns into ash and leaves a void underneath. In underground mines with fire this is one of the reasons of subsidence at the surface.

Figure 2 shows fire that has started in an erstwhile underground mine gallery (now opencast) due to SPC. Measurements were made using CMRI-Wavelet developed software, FRAGALYST. Two types of rocks can be seen in Fig.2, i.e. grey, coarse to medium grained massive sandstone on the top and dark coloured coal with open cleats at the bottom. Despite the fact that the sandstone is of competent quality with RQD of 75-85%, deterioration has started due to fire in coal. Horizontal joints (J1), parallel to the bedding planes, have opened up to the tune of 0.06 m uniformly along the plane. Some blocks of sandstone (B1) have already fallen and some are at the verge of falling (B2), thereby widening the gallery. The coal formation on the right side in Fig.2 has developed tensional (TC) and shear cracks (SC)

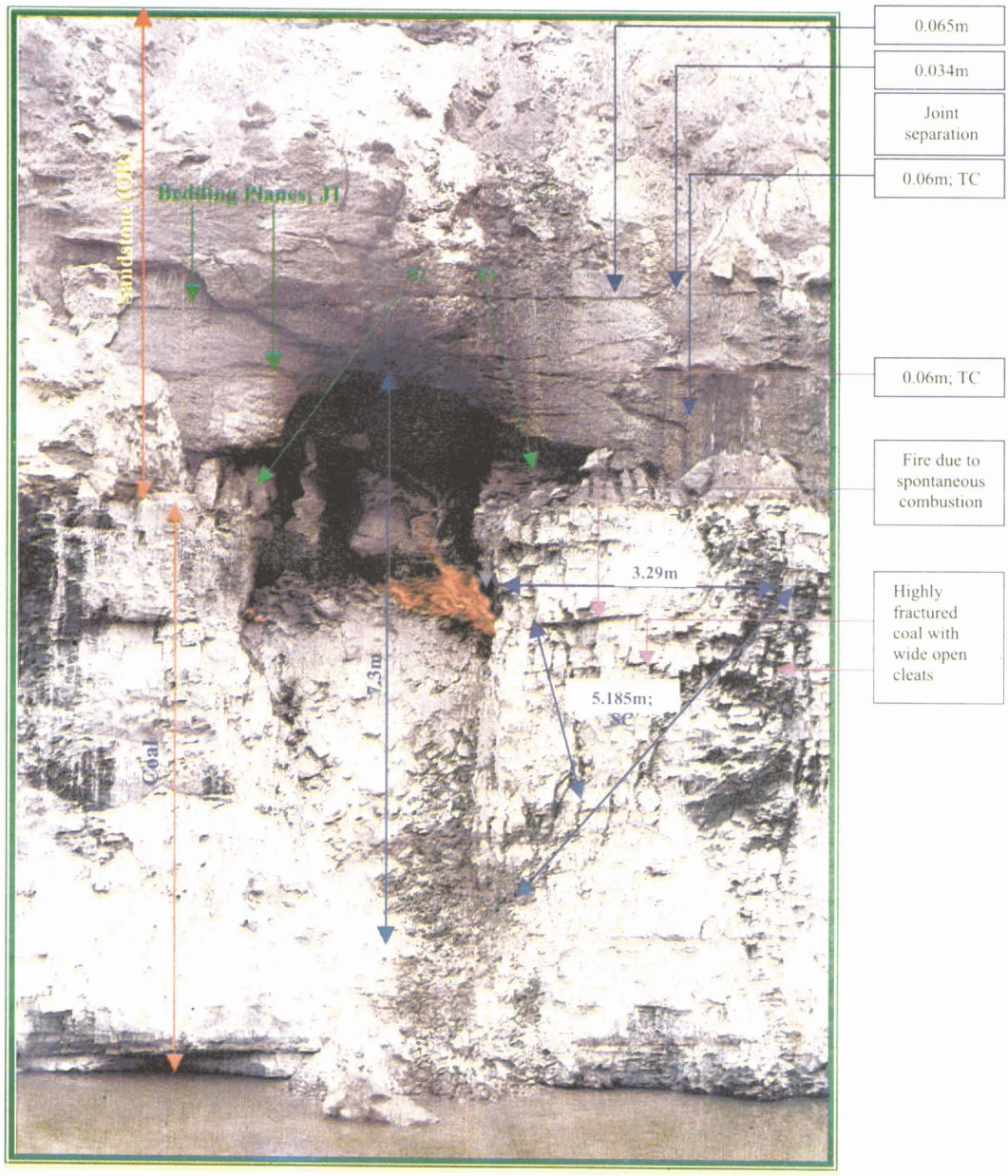

Fig.2. Different aspects of the fire in a erstwhile gallery of Majri opencast mine, WCL; Dimensions measured by using CMRI-Wavelet developed software "FRAGALYST".

due to deterioration of rock mass conditions and redistribution of stress due to fire. The joints and cleats in coal have opened up (*see* dimensions in Fig.2). The process has thereby rendered the whole rock mass unstable. Given that the fire continues, stability would become a major concern. Since there are many overburden (OB) benches above the coal seam this could be of concern in stabilising the slopes in future. It is evident that due to the fire, Rock Mass Rating has come down to 32 from 45 and necessitating a change in the support category.

Although calculations of different parameters for stability analysis are possible but the aim of this note is to make people aware of the consequences and not present an in depth analysis. Nipping the evil in the bud could be a more viable solution i.e. appropriate measures to quench the fire and proper remedial measures, so as to arrest rock mass deterioration with time.

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COASTAL AQUIFERS AND SEAWATER INGRESS IN INDIA*

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EXTENDED ABSTRACT

The long narrow coastal belt in India girdles the Peninsula from the Ganga river mouth to Saurashtra-Kachch through Kanyakumari. Although some of the most prolific aquifers in the country occur in this terrain, salinity hazards in groundwater render groundwater development and management rather complex.

Unconsolidated to semiconsolidated sediments build up most parts of the Indian coasts, a few meters to 600 meters or more in thickness, being rich repository of groundwater. The geological, tectonic and palaeodepositional history determine the occurrence, and distribution of coastal aquifers including distribution of saline and freshwater. As the coastal environments oscillated from fluviatile to fluviomarine and fluvioaeolian, a heterogeneous group of sediments were deposited comprising sand, clay, silt, gravel and limestone, mostly of Tertiary and Quaternary age. Thick, coarse, well sorted and extensive sand layers in the coastal sediments form prolific aquifers. Salinity hazards are mainly due to saltwater ingress where aquifers are open to the sea, entrapped seawater in the marine sediments and seawater incursions through tidal creeks. The hydrochemical profile in the Indian coasts is rather non-uniform with freshwater overlying or underlying or alternating with saline water.

Groundwater occurs under water table condition in the near surface shallow zone, and under confined condition in the deeper aquifers, overlain by thick argillaceous layers. The depth to water table is generally within 2-6 m below ground level. Auto flows in Tertiary sandstones are common in West Bengal, Orissa, Tamil Nadu and Kerala with maximum free flow of 1000 lpm and piezometric head of 13.5 m above ground level.

Starting from the Ganga river mouth in West Bengal the hydrochemical profile undergoes many variations all along the coast. In South 24 Parganas, West Bengal, freshwater aquifers occur in the depth range of 125 – 434 m, overlain and underlain by thick saline zones, and yield 100-300m^3/hr. Salinity hazards extend up to 20-50 kms from the shore. Transmissivity values range from 400- 1930 m^2/d. In Orissa coast this hydrochemical profile undergoes repeated changes with the top saline zone 100-175 m thick in the northeastern parts increasing to 320 m in the Mahanadi delta in the central parts, underlain by deep confined freshwater aquifers. Westwards from the Mahanadi river, down the coast to Puri, aquifers are fresh within a depth of 100 m. In Puri-Balighai coastal strip a second aquifer occurs at a depth of 150 m. Along the coast of Puri in Brahmagiri

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