subsurface sections seems to be near impossible due to extreme magnitude and scale of channel hierarchy. This is also true in the case of Mandapeta field.

2. Nevertheless, in the author's view, a close grid, systematic, extensive and continuous coring in some planned wells would help to some extent in bringing out such a map. But the question is of available core length. To cite one example, for diagenetic characterization of offshore Barremian hydrocarbon bearing sandstones in South Gabon basin, West Africa, the coring density in each well was 420 m, 141 m, 260 m and 163 m (Giroir et al. 1989).
3. Although the main theme of the paper is in the field of sedimentology, the author's effort has been to provide a semblance of synergy and holistic data integration for a meaningful interpretation of the geoscientific problem. Working in a compartmentalised and divisionistic fashion would no longer be tenable in this era of synergy. With this urge, the inclusion of time structure map is a value-addition and is useful for a varied cross section of geoscientists. I hope that this reply answers all the queries of Dr. Rao. Therefore, the conclusions drawn in my paper are in the right perspective and are relevant.

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PHENOL – AN INDICATOR FOR GROUNDWATER POLLUTION BY INDUSTRIAL EFFLUENTS IN DURGAPUR, WEST BENGAL by S. Mahapatra, M. Mahapatra and B. Mondal. Jour. Geol. Soc. India, v.59, 2002, pp.259-263.

S. Das, c/o Dwaipayan Das, 104 Koramangala Industrial Estate, 5th Block, Bangalore - 560 095, comments:

On going through the above article I find some incongruities in their statements which I am discussing below:

1. A perusal of Fig.3 shows a groundwater divide trending NW-SE and running from Kamalpur to Saratpalli and beyond between Arra and Namosagardanga. Groundwater samples from Birja, Dhabani, Shibpur, Malangdighi and Jemua, located on the northern side of the groundwater divide, should not be influenced by the polluting sources 'S_1' and 'S_2' lying on the southern side of the divide. The same is true of the groundwater samples from D. Bandhunagar and Waria lying upgradient from the polluting source 'S_1'.
2. The concentration of the pollutant decreases with increasing distance from the polluting source with more and more recharge in the groundwater flow direction. Further, phenol is likely to be adsorbed by the clayey and silty materials in the sedimentary sequence. Hence influence of the polluting sources S_1 and S_2 at distances of 11 to 18 km is unlikely.

   It is possible that there are other sources for phenolic compounds like coaliferous or carbonaceous deposits occurring below the Neogene sediments in the eastern extension of the Raniganj coalfield.
3. The polluting industries (S_1 and S_2) are located over compact and hard Durgapur beds below a thin cover of soil or alluvium. Hence the scope of extensive pollution through Durgapur beds appears to be rather remote. The major pollutant load may be discharged through local *nalas*, streams. Larger scale maps around the polluting industries will give a better picture of the pollutant movement. Such industries (or point sources of pollution) do have influence on pollution of groundwater, but locally around the industries.
4. Table 1 lists the groundwater samples with their locations, but excludes the sources of water samples – dug wells (unconfined shallow zones), tube wells (deeper confined zone) and depth ranges. After all, the entire sedimentary sequence of several hundred metres cannot be polluted.
5. The authors have not shown the City Centre on the map. The city centre is located right over the Durgapur beds of Jurassic age, which are generally hard and compact. How the authors have correlated the weathered upper parts of Durgapur beds, as

encountered in the top 100 m of the borehole at city centre with Neogene formations in the east?

Samiran Mahapatra, Department of Geology, Durgapur Government College, Durgapur - 713 214, West Bengal, replies:

My thanks are due to Mr. Das for showing keen interest in our paper. I hope the following reply will help him to clear his doubts.

1. The NW-SE trending groundwater divide is not an obvious phenomenon throughout the year. Seasonal fluctuation of water table often changes the local flow direction and the position of so called groundwater divide (for details please see Adhikari et al. 2000). Again though the regional flow direction is towards SE, still locally some flow occurs whose direction may differ from the regional flow direction. As for example, local flow direction near Nadiha (Fig.3) is towards south, near Kuldiha towards southwest, near City Centre almost towards south etc. Moreover, at the source region due to continuous supply of pollutant-laden water, recharge mounds develop from which migration of contaminant plume starts in all possible peripheral directions depending upon the head difference. If hydraulic continuity between different acquifers exist (both vertically and laterally), the contaminant may affect distant aquifers too.
2. The local geology of the study area reveals that the clay present is montmorillonitic in composition, the buffer capacity (measure of contaminant attenuation capability) of which is very poor.

   Moreover, in case of organic clay interaction, the greater the dielectric constant of the organic compound, the greater is the value of the permeability coefficient. Dielectric constant also serves as an approximate measure of the liquids hydrophilic or hyrophobic character. Phenol, a DNAPL (dense non aqueous phase liquid) with high dielectric constant tends to be hydrophilic and is expected to move quickly through the aqueous channels in the clay and meet the groundwater body.

   Any evidence of the phenolic compounds being derived from coaliferous or carbonaceous deposits of Raniganj coalfield of Gondwana basin to the aquifers of Durgapur area forming the part of Bengal basin is not observed by the present workers. Again, no appreciable amount of phenol is likely to come directly from coal beds; it generally forms after some industrial processing of coal. Even if we accept Mr. Das's suggestion, the concentration of phenol should have been higher in the places lying nearer to the Raniganj Coalfield area than the place lying farther apart, which is not the observed fact.
3. S_2 (not both S_1 and S_2) is located over Durgapur beds. Though the actual stratigraphic status of the sediments present in the Durgapur area is not yet well established, Das and Biswas (1969) identified the sandstones exposed in and around the City Centre area as Durgapur beds. These sandstones are not at all hard and compact, they are friable, unconsolidated to semi-consolidated in nature resulting in high porosity and permeability. However, locally these sandstones seem to be massive due to lateritisation. In fact, all the sediments exposed in the Durgapur area are unconsolidated to semi-consolidated.
4. All the groundwater samples are taken from the dug wells with water depth ranges between 1 m to 11.3 m.
5. Only those positions are shown in the map (Fig.1) where groundwater samples are collected and where the people use groundwater. The residents Durgapur Township proper along with City Centre use tap water. The water is coming from Damodar Reservoir after treatment.

   The perspetive fence diagram (Fig.2) has been prepared to understand the potential productive zones, hydraulic continuity of the aquifers, path of groundwater movement and zone of intermixing of groundwater of different aquifers, particularly the vertical inter-aquifer movement of groundwater. This has been done not on the basis of stratigraphic considerations but has been prepared by correlating the lithologs on different locations on the basis of hydrogeological aspects of the formation materials and the elevation aspects.

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