discharge rate. The variation in the abstraction rate is included in the method and it is accepted as an input into the program (please see the flow chart as well as the program).

In case we have data on the fracture (its orientation and other details) we can take into account such information and use appropriate method to interpret pump test data.

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## OCCURRENCE OF FULLERENE BEARING SHUNGITE SUITE IN MANGAMPETA AREA, CUDDAPAH DISTRICT, ANDHRA PRADESH

by K.S. Misra et al. Jour. Geol. Soc. India, v.69, pp.25-28.

**Suresh Kharkhanis**, Analytical Research Laboratory, Department of Polymer and Petroleum Engineering, MIT Engineering College, Kothrud, Pune - 411 038 comments:

The paper invites a legitimate hard question, such as whether this fullerene that authors have identified is *organic or inorganic*. There is no reason why with the help of suitable transition elements a fullerene-like material could not be produced. Tenne et al. (1992) have successfully synthesized cage structures from tungsten sulphide, which structurally is closely related to molybdenum and tungsten selenide both are layered materials. Inductively coupled Plasma Mass Spectrometric (ICP-MS) analysis presented by the authors has indicated presence of certain competing trace elements at ppm levels. There is therefore every possibility of forming a *doped (?) caged $C_{60}$ or $C_{70}$ structure.*

Shungite by definition is impure graphite, which is hard, black amorphous, coal-like material containing over 98% carbon. It is probably the metamorphosed equivalent of bitumen. Their fullerene was found in Shungite bearing rock. This may be their convincing evidence that this structure is organic fullerene.

$C_{60}$ molecules form face-centered-cubic solid – (fcc): For this molecule there are three available sites, where other atoms can occupy the space. Octahedral site and other two sites or tetrahedral sites. With the former A1 $C_{60}$ molecule can form where A = K, Rb, Ca. When more alkali metals are stuffed one can produce A3 $C_{60}$ or A4 $C_{60}$ molecule with body-centered Tetragonal structure – (bcc). Spectroscopic characterisation of thus modified $C_{60}$ (?) is necessary to establish organic versus inorganic criteria. Techniques such as IR, Raman, optical and luminescence measurements (Kozlov et al 1997) backed up by high resolution transmission microscopy (HRTMS) and powder X-ray diffraction (Buseck, 1992, 2002). Lastly, if $C_{60}$ molecule is doped with some compatible inorganic ions then i) it is no more all carbon molecule ii) it may not be spherical iii) it therefore, could be endohedral material. The question arises that if the criteria (i) and (ii) are not satisfied by that particular molecule – then should it be addressed as a fullerene? It is upto the chemists/geochemists to try to change the terminology through International Union of Pure and Applied Chemists (IUPAC).

**K.S. Misra, M.R. Hammond, Anant V. Phadke, Fiona Plows, U.S.N. Reddy, I.V. Reddy, Fareeduddin, G. Parthasarathy, C.R.M. Rao, B.N. Gohain and Dinesh Gupta** reply:

We thank Dr. Suresh Kharkhanis for his comments. Dr. Kharkhanis has addressed three aspects. (1) Nature of fullerene in our samples from Mangampeta i.e organic or inorganic, (2) doping of fullerenes with compatible inorganic ions and (3) definition of Shungite and (4) characterization of fullerenes by spectroscopic methods. While thanking Dr. Kharkhanis for the inputs on fullerenes, we provide our reply on these four points.

1. Our studies have so far suggested that the fullerenes in the sample are organic in nature.
2. The doping of the cage structures is beyond the scope of our study. However, if the fullerene is doped with transition metal(even at ppm level), we would have observed it in the mass spectra. The fact that the laser-desorption /ionization mass spectra of the acid-resistant carbon residue showed only the presence of $C_{60}$ and $C_{70}$ and not any presence of transition metals in the fullerenes from Mangampetta. The

ICP-MS analyses were on the shungite whole-rock sample and not on the acid-resistant carbon residue The carbon residue contains only $C_{60}$ and $C_{70}$ and not any transiti on metal impurity

3 The definition of shungite needs to be addressed here Buseck et al (1997) have reviewed the various usages of the term shungite in literature (for details and references please refer Buseck, ibid) The term shungite has been used to describe all carbon bearing rocks of Lake Onega region, Karelia, Russia with the different types of shungite distinguished by their carbon content Some authors use it to describe the structural state of their carbon, so that the shungite has been applied to both the rocks and their elemental carbon A few others use it as adjective, as in Shungite-slate and Shungite-diabase, whereas others refer to Shungite rocks and then specify types A third procedure is to use both terms e g , "lydite (type-V Shungite)" Buseck et al (1997), however, have followed the prevailing usage and used the term shungite to designate reduced-carbon bearing rocks from Lake Onega region They further classified five different types of shungite based on carbon contents (Type –I = >75%-98%, Type-II = >35% to 75%, Type-III = >20% to 35%, Type IV >10 – 20% and Type – V = <10 %) Therefore Dr Kharkhanis's assertion regarding the shungite definition is not correct

4 The characterization of fullerenes by laser ionization mass spectroscopic method is a well-established procedure However, if the fullerene extract is more than few mg level then the powder-XRD, UV-Visible , Raman , Nuclear magnetic resonance (NMR) and FT-IR spectroscopic methods are used (Please see Parthasarathy et al 1998, 2003, 2008) The use of mass spectroscopy and gas chromatography-mass spectroscopy are the well-known methods for identifying the fullerenes

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## NEW OCCURRENCE OF MANGANO-COLUMBITE FROM LATE PROTEROZOIC PEGMATITES OF BHURPIDUNGRI, JHARSUGUDA DISTRICT, ORISSA by P. Jagadeesan, K.S. Mishra and P.V. Ramesh Babu. Jour. Geol. Soc. India, v.66, 2005, pp.141-144.

**S. Viswanathan,** Hyderabad – 500 016, responds to author's reply·

The "six observations" made by the authors in their reply clearly reveal that they have not comprehended the importance and significance of my comments Some of their statements are also misleading

*Observations 1* I wonder how the authors got the impression that I was trying to get credit for the late B N Tikoo for being the first to recognize manganocolumbite in India in the Bihar Mica Belt All that I had mentioned was that, Tikoo had found columbite-tantalite with high MnO contents in several localities of the Bihar mica-pegmatite