

## Chikungunya – Pain and gain

The outbreak of chikungunya has created havoc in India especially in states like Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu and Kerala. Nearly 200,000 people in Andhra Pradesh and at least 80,000 people in Gulbarga, Tumkur, Bidar, Raichur, Bellary, Chitradurga, Davanagere, Kolar and Bijapur districts of Karnataka state were affected. Around 43,000 cases in Kerala have been suspected with the disease. A total of 1.8 lakh cases have been reported in India since December 2005. Considering the seriousness of the disease outbreak and to curb the menace, the government has recently sanctioned Rs 1 crore. Chikungunya virus belongs to the genus Alphavirus and family Togaviridae. It was first isolated from the blood of a patient with fever in Tanzania in 1953. It is a mysterious disease which vanishes on its own, after a few bouts of pain and suffering. The disease is yet to be diagnosed by the doctors. The medical experts have observed that it is not a deadly disease and does not require any specific treatment. However anti-inflammatory agents and analgesics can be given for symptomatic

relief. It may sound unbelievable, but it is a fact that medical practitioners, in backward areas of Andhra Pradesh and Karnataka, bent on making money by unethical means, are treating the disease with injudicious medicines. Surprisingly all the patients who are reporting to these medical practitioners with pain in joints and fever are treated alike. In some cases, patients were not subjected to any check up but were directly administered a bottle of saline into which a vial of diclofenac, a painkiller, was injected. The patients are being charged a price of around Rs 200–300, though the actual cost of this treatment including drip-set, is just about Rs 50. The treatment is repeated on the basis of the patients' paying capacity. Some deaths have been reported, not because of the disease, but mainly due to inappropriate use of antibiotics and anti-inflammatory tablets<sup>1</sup>. As this virus can cause thrombocytopenia, injudicious use of these drugs can cause erosion in gastric epithelium leading to exsanguinating upper gastrointestinal bleeding (due to thrombocytopenia) which may be fatal.

On one side there is suffering and pain and on the other side there is monetary gain to some physicians, pharmacists and pharmaceutical companies. It is the responsibility of the government and health care professional associations to take appropriate action against perpetrators who are earning money by deceiving gullible patients. Further, state governments of most affected areas should appoint a team of experts to eliminate the disease and even the public has to take initiative to eradicate the vector (*Aedes mosquito*) which carries the mysterious virus.

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## Structure and tectonics of Kachch Basin and earthquakes

I agree with the suggestion made by Roy<sup>1</sup> that there is an urgent need to understand the geological evolution and tectonic history of Kachch Basin in view of its unusual sensitive seismicity. The investigations should be carried out by an interinstitutional and interdisciplinary team of geoscientists, keeping in view the following characteristic features of the region. (a) Chemical and thermal anisotropy of the region indicative of igneous activity of different pulses; (b) Elevated basement indicating underplating and uplift; (c) high heat flow and low velocity anomaly indicating the presence of a possible 'fossil' plume head. All these features are suggestive of recurring plume activities in the region.

The Kachch region, proximal to the Cambay Gulf is situated to the NW of the main Deccan volcanic province and SW of the zone of low velocity anomaly

(Figure 1). The Kachch rift is bound by the Nagarparkar fault on the north and south and Kathiawar fault on north. The uplifted Precambrian block represents the rift shoulders. The Kachch rift is vulnerable to seismicity due to its proximity to the western plate margin Chaman fracture zone and Mekran subduction zone.

The Reunion mantle plume is considered to be responsible for the late tectonic igneous activity, the Deccan trap flows and related intrusions. Localization of intrusive bodies along the master faults in the central region points to the existence of faults prior to the plume activity<sup>2</sup>. These plugs of alkaline basalt affinity with mantle xenoliths of spinel lherzolite and olivine are manifestations of Deccan traps exposed to erosion. The composition of alkaline rocks is consistent with marginal rifting and with OIB-type geochemical characters similar to Reun-

ion source. Further, there has been an addition of subcontinental lithospheric material<sup>3</sup>. According to Basu *et al.*<sup>4</sup>, alkaline magmatism north of Deccan flood basalt at Mer Mundwara and Sarnu-Dandali (along the Cambay rift) is slightly older (3.5 Ma) as compared to the rocks of the area further south. This magmatism is directly related to the Deccan plume due to their high <sup>3</sup>He/<sup>4</sup>He ratios of 12.8 RA for Sarnu-Dandali rocks, and 13.9 RA for Mer-Mundwara rocks. The Sarnu-Dandali alkaline rocks occur on the basement of Malani volcanics in the Barmer district, Rajasthan. This indicates that the Cambay gulf was active 3.5 Ma before the rapid eruption of bulk of Deccan traps took place and suggests the temporal and structural contiguities of Mer-Mundwara and Sarnu-Dandali magmatism with that of the Deccan province. Incidentally the Cambay basin is characterized by second



**Figure 1.** Part of NW Indian shield showing the major lineaments and location of alkaline complexes. TAB; Trans-Aravalli block; SD, Sarnu-Dandali; MM, Mer Mundwara; S, Siwana ring structure; N, Nagarparkar; SHR, Saurashtra; Narmada-SL, Narmada-Son lineament.

highest heat flow ( $93 \text{ mWm}^{-2}$ ) next to Tusham ( $96 \text{ mWm}^{-2}$ ) in the TAB. The average heat flow value for Aravalli-Delhi mobile belt is  $60 \text{ mWm}^{-2}$ .

There appears to be correlation between seismicity and igneous intrusions. The circular gravity high around plug at Wagad and the Pachham uplift coincides with the epicentre of the most destructive earthquakes in the region, viz. Kachch earthquake of 1819 and Bhuj earthquake of 2001<sup>5</sup>. According to Roy<sup>6</sup> the northern Gujarat and western Rajasthan show highly irregular but clustered gravity high indicative of mafic/alkaline plutonic intrusions at surface and underneath indicating magma channelling along rift shoulder.

Kennett and Widiwanto<sup>7</sup>, based on the *P*-wave arrival time have delineated a low velocity anomaly to the north of Gulf of Cambay (Marwar terrain, i.e. the Trans-Aravalli block of the Indian Shield). The feature is 120 km across and is in marked contrast to high seismic velocities beneath peninsular India. The anomaly extends from shallow depth to more extensive low velocity zone below 200 km depth beneath the Indian lithosphere. The centre of this approximately circular anomaly lies just below the Mer-Mundwara, Sarnu-Dandali complexes and Siwana ring structure (Figure 1). The low velocity feature may represent a 'fossil' expression of the plume head, designated as the Malani plume by Kochhar<sup>8</sup>. This plume was responsible for the outpouring of the world's third largest felsic magmatism, the Malani volcano-plutonic magmatism, resulting in the assembly of the Malani Supercontinent<sup>8-10</sup>.

It is obvious that there has been recurring plume activity in the region. The Malani plume gave rise to anorogenic, bimodal A-type, volcano-plutonic magmatism. Minor amount of basalt, gabbro and basic dykes also occur in the suite. These basic rocks are exposed in Siwana, Jalor and Sarnu-Dandali areas of Rajasthan, and Nagarparkar, Sindh district of Pakistan. There is every possibility that high density basic material of Malani age may still be preserved in the Kachch region. This would certainly contribute to gravity high in the gravity analysis. The time gap of ca 700 Ma between the outburst of Malani plume and the Reunion plume corresponds with the assembly and dispersal of three large supercontinents, i.e. Columbia, Rodinia and Pangea<sup>11</sup>. This is due to the periodic loss of mantle thermal energy on account of generation of plumes and superplumes in the earth's history<sup>12</sup>.

The Malani plume would have caused dynamic uplift and tensional forces which enhanced the incipient rifting. Most of

the faults and lineaments (including Son-Narmada lineament) are of fundamental nature (mantle) attributed to the Malani plume. These were subsequently reactivated and became sites of igneous (intrusions) activity due to the northward movement of Indian plate over Reunion plume. The lineaments acted as locales for subcrustal magmatism and surface volcanicity and storehouse for fluids.

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