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Mitigation of the COVID ۱۹ Pandemics in tectonically active areas.

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Abstract

Tectonically active areas when release hydrogen peroxide (H_2O_2) it can kill the COVID ۹۹ virus naturally in the environment. COVID ۹۹ contaminations can be controlled by identifying tectonically active areas in India and other similar terrain globally. Using high resolution satellite data it is possible to infer the changes in the surface manifestations in terms of changes in, vegetation vigor, lineament and other landform features. Thermal scanners by drones and field observations can identify potential fractures and faulted areas to release hydrogen peroxide (H_2O_2). In ferruginous quartzite, granite and other hard rocky terrain the natural release of hydrogen peroxide by micro tremor in presence of moisture content can mitigate the Corona virus by killing it insitu naturally as public health medicine. Initially the new concept needed to be propagated through scientific communication and education. If this hypothesis is proved experimentally correct it will be a new finding and a great relief to the humanity across the world.

Keyword: COVID ۱۹, Pandemics, Tectonically active,

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Introduction

It is a matter of great concern that the COVID ۹۹ pandemic has shown a dramatic reduction in India generally and in Delhi and surrounding areas in particular. National Capital Region of India has shown influence of neotectonic activities, which has changed the groundwater quality in Delhi Haryana region. Monitoring of stress within bedrocks along active fault zones have been under observation for detecting premonitory earth quake signals. Common crustal high grade metamorphic and igneous rocks contain peroxy defects which remain dormant until the rock experiences stress. These stress activated defects form highly reactive oxygen species (ROS) which produce electric currents. At the rock-water interface, the ROS can combine with groundwater to produce hydrogen peroxide giving an indirect measure of the underlying rock stress along active fault planes within hard rock aquifers and deep thermal springs[1]. Disruption within the ground layers can influence both the quality and quantity of groundwater within aquifers. This change can be brought about due to mixing of water between different aquifers, influx of water from surrounding areas, changes in dissolved gas concentrations and mineral dissolution at the rock-water interface or through infiltration of pollutants from soil or ground surface[2,3].

Rock stress area investigation

Changes in the chemical properties of groundwater can be brought about by change in local water circulation and change in temperature and water pressure within rocks and aquifers[4]. Seismic activity can induce hydrochemical changes depending on the hydrogeological properties of a seismogenic area. It has been observed that in the process of igneous rock formation, water gets incorporated into the mineral grains in the form of hydroxyl radicals upon crystallization from water laden magmas, even within anhydrous mineral grains [4,5]. The production of hydrogen peroxide is however suggested to be primarily produced within stressed crustal rocks by the transfer of the positive holes[6]. Besides terrestrial rock stress, it has been observed that freshly crushed basaltic soil and rock samples from Martian and lunar crusts formed highly reactive radical species on the surfaces of the crushed samples due to breakage of bonds once the rocks underwent severe mechanical stress upon grinding[7]. These radical species produced ROS such as hydrogen peroxide (H_2O_2), hydroxyl radical (OH^-) and superoxide ion ($O_2^{\bullet-}$) once the crushed rock was immersed in water[8]. Hydrogen peroxide is well known for its inactivation of Virus in tectonically active rocks and insitu plants in hilly areas[9] due to increase production of H_2O_2 [00-11].

Result

Tectonically active areas can reduce COVID *99* pandemic

It is a new finding about possibility of reduction of COVID *99* virus in neotectonically active areas. In tectonically active areas the slow release of hydrogen peroxide may be a boon. Identification of active faults and superimposed COVID *99* affected areas can be initiated to develop a possible global solution to develop the artificial micro tremor in areas affected by COVID disaster.

The geology of the Delhi area is characterized by the Precambrian metasediments of the Delhi Super group with widespread occurrence of quartzite, schist, siliceous limestone, slates and phyllites[22]. A North -South oriented seismogenic Sohna fault associated with the Himalayan orogenic movement runs from Sohna to the Delhi Ridge, west of New Delhi existing below the alluvium in the vicinity of the thermal spring (Fig. ۱)[13].

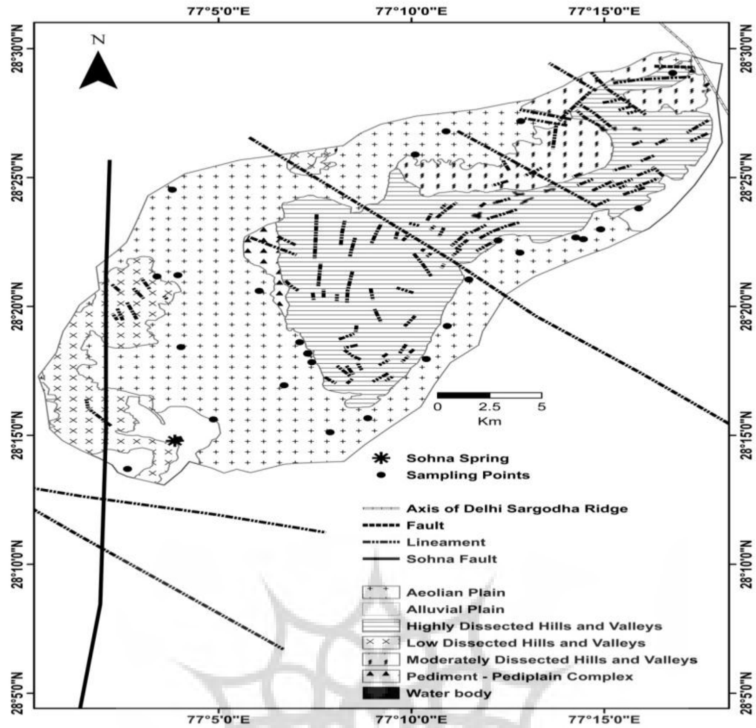

Fig. ١. Geomorphology map of the Study Area

The thermal spring falls within a geothermal field in the tectonic depression formed by the downward faulting of a central block lying between two anticlinal ridges belonging to the Delhi belt. It is located at the hinge region of the synformal fold within the tectonic depression (Figure.٢) [٧٧]. The region to the north and east of the spring is occupied by alluvium whereas the southern and western parts are covered by Alwar Quartzite of the Delhi super group. The alluvium on the east of the spring comprises of aquifers made up of sand with some silt and clay. On the west of the spring the alluvium consists of gravel, sand, silt and clay. The western alluvium is devoid of good aquifers due to the presence of calcium carbonates acting as cementing material [١٤].

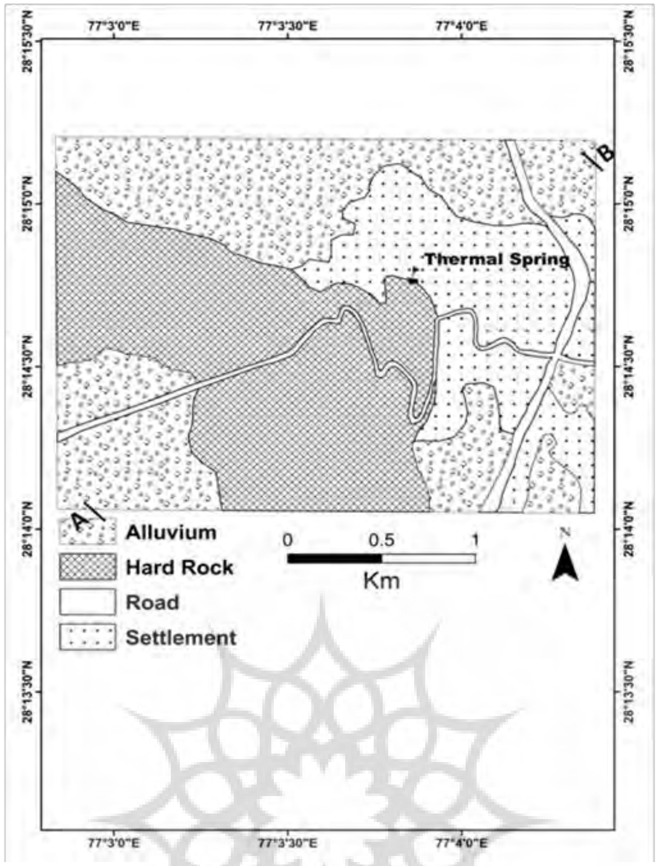

Fig. ۲. Geological Map of the region of Sohna thermal spring

The ferruginous quartzite of the anticlinal ridges are highly jointed and compacted with the joints occurring in two sets; one lying perpendicular to the bedding plane and the other lying parallel. The unique pattern of joints within the rock is such that it gives rise to rectangular blocks of quartzite providing passageways for the circulating water to reach substantial depths [۱۵, ۶۶]. The water table of the region follows the topography with the wells lying close to the ridge to be of deeper origin. The fractures and joints within the quartzite bedrock constitute the water bearing zone whereas the rest of the hard rock region has a poor capacity to store and transmit water [۷۷].

Sohna Spring

The spring is located at an altitude of ۰۰۰ ft. from the mean sea level. The water has been reported to be emanating out of a fissure within the Pre-Cambrian quartzite bedrock. The temperature data collected previously from different tube-wells and dug wells within the region suggests that the geothermal field extends over an area of approximately ٤. ۰۰۰۰ sq. ft. [۸۸]. The water circulation drains from the western alluvium travelling through the pattern of fractures and joints till the hinge region after which it finally issues out as a spring (Fig. ۳). The circulation pattern of the water therefore is inferred to be the main factor influencing the changes in the geochemistry of the spring water.

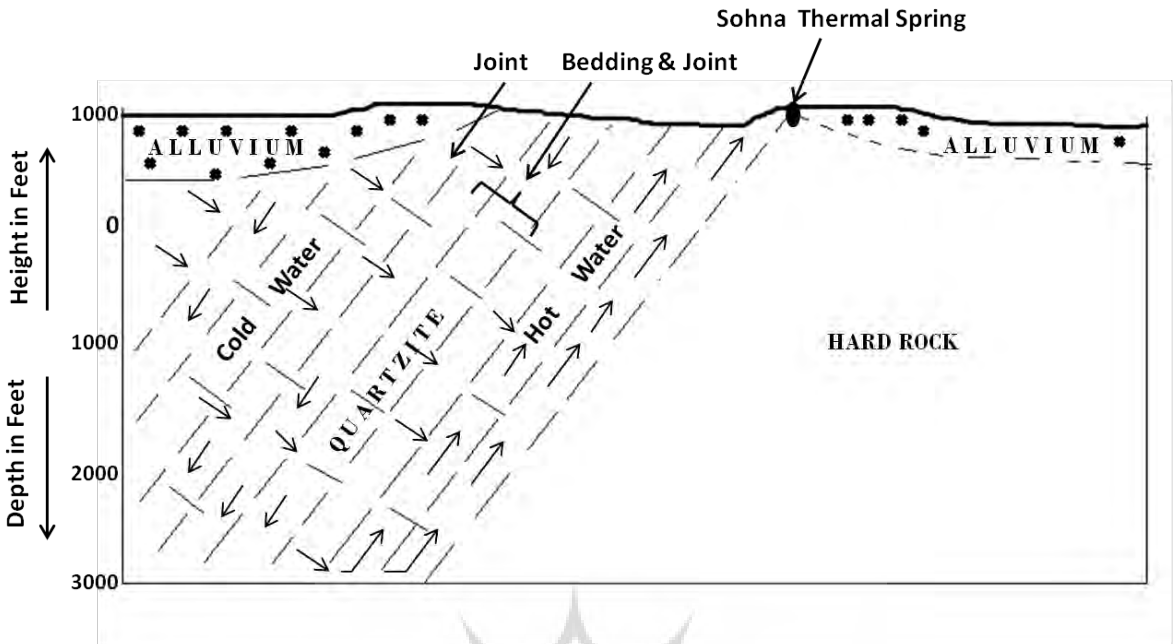

Fig. ٣. Generalized diagrammatic representation of spring water circulation (modified from Deb & Ray, ١٩٧١) along the segment A-B marked in Fig. ٢

The bedrock in the region of the thermal spring consists of quartzite with intercalations of muscovite schist, Kyanite schist and Phyllite with a provenance dominated by evolved granitic rocks [١٩]. The majority of the bedrock is composed of quartzite which is an intermediate to high grade metamorphic rock formed when quartz-rich sandstone is exposed to high temperatures and pressures often along tectonic boundaries. It is non-foliated, medium grained and almost entirely composed of quartz mineral [٢٠]. Schist is produced by medium to high grade metamorphism consisting of mineral grains of quartz, feldspar, muscovite, biotite and chlorite [٢١]. Phyllite, on the other hand is a fine grained, low grade metamorphic rock composed of mineral grains of muscovite, chlorite, biotite along with graphite and iron oxides [٢٢].

Evidence of simultaneous hydrogen peroxide and hydrogen gas production at rock water interface

The interaction of water with the underground stressed rock volume at the rock-water interface is considered key to the production of hydrogen peroxide. Laboratory simulations have shown that at the rock water boundary, the p-hole (O^-) turns into a highly reactive oxygen species))))))) eee rrr m ff OO aaaaaal cccc . converts H_2O into H_2O_2 [٢٣]. According to the reaction, for every two positive holes, one H_2O_2 molecule is formed. The closure of the battery circuit in the lab simulation was achieved by joining the stressed rock end to the unstressed rock end through a copper wire. In the field, the closure of the circuit can be achieved by the electrolytical conductivity of water which is represented here by the hard rock aquifer such as the Sohna geothermal aquifer. The concentration of hydrogen peroxide in the water samples collected from the spring and from the borewell north of the spring was the highest as compared to the groundwater samples collected from the western and eastern alluvium and also the samples collected from the surrounding hard rock aquifers.

Studies on crystalline oxides and silicates reveal the migration of mobile positive holes within the mineral sub lattice. Evidence also suggests that redox reactions involving the splitting off of H_2 to form peroxy anions occur within fused silica wherein O_3SiOH pairs are converted into H_2 and peroxy links (O_3Si – OO –SiO_3) . Molecular hydrogen (H_2) production also takes place due to charge transfer conversion of Si-OH pairs into Si-O/ \O-Si + H_2 [eq.۸] .

Si-OH HO-Si → Si-O/ \O-Si + H_2 (۸)

This hydrogen production has been evidenced to be frictionally driven during rock fracturing associated with cataclastic rock. It has been reported that hydrogen gas generation increases with high frictional work associated with even small magnitude earthquakes. High concentration of dissolved hydrogen (۰۱۷۸۸ cm۳ STP/l) was also reported in the Sohna spring water samples [٤٤]. Therefore, a longer circulation time of geothermal water through the interconnected fractures within the stressed quartzite bedrock could possibly lead to the observed increase in the dissolved hydrogen content. Thermal camera images from the exposed hard rock show that the region with fractures/joints has higher internal temperatures as compared to the rest of the rock (Fig. ٤) which validates frictional work acting along the fracture planes leading to higher temperatures due to release of heat.

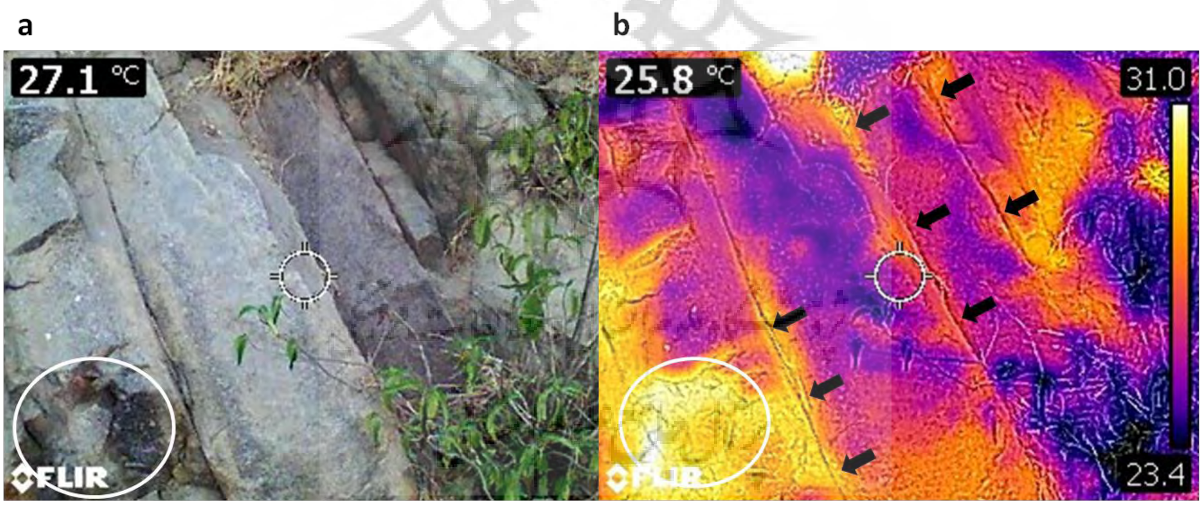

Fig. ٤. (a) Camera image of the exposed quartzite hard rock near the geothermal spring at ٢٨٢٢٤٤°N, ٧٧٠.٦٥ °E,; (b) Thermal camera image of the region in (a) showing higher internal temperatures at the fractures planes (black arrows); white circle encloses the broken and freshly exposed quartzite rock having high temperatures as compared to the intact rock.

The anomalous high hydrogen content has been speculated to be the result of the reaction between groundwater and Si and Si-O radicals produced by rock rupture due to friction along the active fault plane. It is also suggested that the same mechanism also leads to the formation of hydrogen along active faults when freshly exposed bedrock reacts with groundwater due to fault

movement [۷۷]. The high concentration of hydrogen gas therefore can be attributed to the reactions involving water and Si and Si-O radicals produced once the rock experiences rupture due to friction along the fault plane.
The long circulation time and the velocity of water flow as well as the high production of hydrogen gas and dissolved radon, both suggest that the presence of hydrogen peroxide within the geothermal waters can be attributed to the stress activation of positive holes taking place due to continuous frictional activity due to fault movement along the active fault plane.
All the above observations point at two important deductions, one that the region experiences continuous seismic stress evident from the frequent micro tremor activity and secondly that higher concentration of hydrogen peroxide measured in the spring water sample is associated with this stress build-up activating the peroxy defects within the bedrock oriented along the fault zone. The hydrogen gas and hydrogen peroxide production both are inferred to be the result of rock water interaction taking place due to constant availability of freshly exposed rock surface for aqueous chemical interaction along the active fault zone.
Alternately, study discussing the dark production of hydrogen peroxide in the alluvial aquifer of Rifle, CO suggests that the production of hydrogen peroxide is highly spatially variable governed by several processes such as dark biological production, metal-mediated oxidation of organic matter and cycling of metal species (e.g. Iron) through a series of redox reactions. The absence of Iron species in the thermal spring water sample suggests that the interconversion of $Fe^{۲+}$ to $Fe^{۳+}$ is not solely responsible for the generation of hydrogen peroxide. Wilson et al., *0000* suggested the photochemical production of hydrogen peroxide by pathways involving the decay of DOC (dissolved organic carbon) by biological activity of thermophilic bacteria. This process can also be ruled out since the water issues out from a highly deep circulation path (~۳۰۰۰ ft) in the spring and therefore the influence of light mediated reactions taking place at these depths is highly unlikely. The production of hydrogen peroxide in the Sohna spring water sample therefore seems to be largely dependent on the conversion of ROS species (O^-) produced through the transfer of stress activated electronic charge carriers within the high grade metamorphic subsurface rock.

Recommendations

Similar studies are recommended in other parts of the world where the pandemic has reduced dramatically after the repeated micro tremor. The present study is a hypothesis proposes that deep thermal springs lying close to active fault zones can act as suitable sites for estimation of the underlying rock stress based on hydrogen peroxide concentration as the aquifer water is constantly in contact with the bedrock. Changes in the concentration of hydrogen peroxide would indirectly indicate and predict the seismic stress build-up along rupture zones leading to earthquakes. Similar condition can be induced in other areas to produce H_2O_2 naturally to reduce the spread of Corona virus in global terrestrial environment as public health medicine. Satellite remote sensing and Geographic Information System can be of great help to identify and mitigate not only COVID *99* but in future any new trend of Viral or other microbial threat to the living beings of the Earth.

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کاهش بیماری همه گیر COVID ۱۹ در مناطق فعال تکتونیکی

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چکیده:

مناطق فعال تکتونیکی هنگام آزاد شدن پراکسید هیدروژن (H_2O_2) می تواند ویروس COVID ۱۹ را به طور طبیعی در محیط از بین ببرد. با شناسایی مناطق فعال تکتونیکی در هند و سایر مناطق مشابه در سطح جهان می توان آلودگی های COVID ۱۹را کنترل کرد. با استفاده از داده های ماهواره ای با وضوح بالا ، می توان تغییرات در تظاهرات سطح را از نظر تغییرات ، قدرت پوشش گیاهی ، خطوط و سایر ویژگی های شکل زمین استنباط کرد. اسکنرهای حرارتی توسط هواپیماهای بدون سرنشین و مشاهدات میدانی می توانند شکستگی های احتمالی و مناطق گسیخته را برای آزادسازی پراکسید هیدروژن (H_2O_2) شناسایی کنند. در کوارتزیت فروسین، گرانیت و سایر مناطق سخت سنگی ، انتشار طبیعی پراکسید هیدروژن توسط میکرو لرزش در صورت وجود رطوبت می تواند ویروس کرونا را با از بین بردن آن به عنوان داروی بهداشت عمومی در بدن ، کاهش دهد. در ابتدا مفهوم جدید نیاز به تبلیغ از طریق ارتباطات علمی و آموزش داشت. اگر این فرضیه از نظر تجربی درست اثبات شود ، یافته جدیدی خواهد بود و تسکین بزرگی برای بشریت در سراسر جهان است .

کلید واژه۱۹ COVID : ، بیماری های همه گیر ، ساختاری فعال ، داده های ماهواره ای