

Favourable Factors for Uranium Mineralization in District Surguja, India

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Abstract. In view of world analogy for the favorable sites of Uranium mineralization in the sedimentary Proterozoic rocks, the ENE-WSW trending Narmada-Son Lienament/ fractured basement of Proterozoic Arachean age overlain unconformably by the Gondwana Super Group sandstones of Mesozoic to Lower Permian age in District Surguja offers an ideal site for the Uranium mineralization. Some of the favourable factors, namely, the nature of basement rocks present in the area, surrounding rocks, type of environment which favours the mineralization and tectonic features etc have been discussed.

Introduction

Despite India's extensive development achievements in the last more than five decades since independence, the fact remains that it is still remains on the poorest nations in the world in terms of per capita income and energy consumption. The per capita energy consumption which indicates the economic status of a nation, is only 0.25 tons of oil equivalent (toe) as against nearly 8.5 toe of developed nations. If the economic standard of the country is to be raised, an accelerated growth of economy becomes imperative which can greatly be facilitated through increased availability of energy, be it a conventional or non conventional source of energy. Fortunately, India has vast unexploited resources of power estimated at about 84000 MW, the harnessing of which is expected to meet the domestic demand of ever growing population on one hand and relieve the country from heavy burden of foreign exchange outflow and dependence on imported fuel for generating electricity on the other hand. Any new find of uranium obviously plays a significant role in country's development.

Area under study

The study area is located near the border of the Chattisgarh and Bihar states and falls close to the regional Balarampur fault zone and spread over an area of about 400 m x 600 m and perhaps, the ENE-WSW trending Narmada-Son Lienament (NSL) zone is one of the most significant lineament in the Indian shield. Tattapani fault is a major fault in the region forming a boundary between Archean formation towards the south and the Gondwana formation towards the north (Fig. 1) in the western part of the study area.

Geology of the Area

Detailed geological studies have been carried out by Geological Survey of India (G.S.I.; Thussu et al. 1987). The surface geology presents different rock types, which include quartzite, schist, gneisses and phyllite of Proterozoic Arachean age. These are generally folded and cross-folded. The Archean rocks show foliation in the direction N70°E—S70°W and N80°W—S80°E with dips of 75° to 85° towards north. Granites, granodionites, pegmatites, amphibolites and quartz veins represent the intrusive rocks of the region. The phyllites are mainly carbonaceous and graphites are associated with Pyrite mineralisation. The granites and granodiorites occur as plutons while the amphibolites occur as dykes and sills and the pegmatite as intrusive. Quartz veins are associated with magnetic mineralisation. Table 1 presents the stratigraphic sequence of the formations.

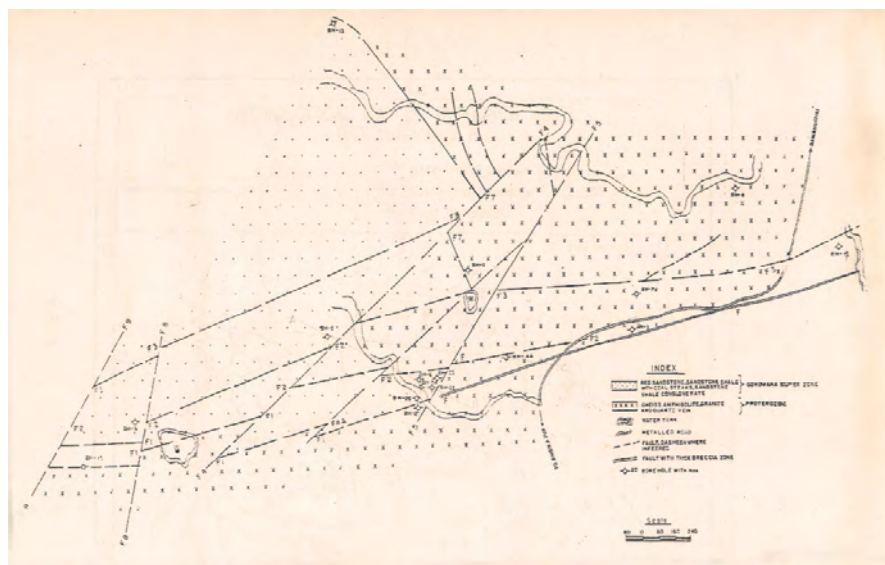


Fig. 1. Geology of the study area forming part of District Surguja.

Gondwana sequence of formations in this area, lying unconformably over the Proterozoics, consists of conglomerates, sand stones, shale and minor coal beds. These show low dips (15°) with a general strike direction of $N80^{\circ}W-S80^{\circ}E$.

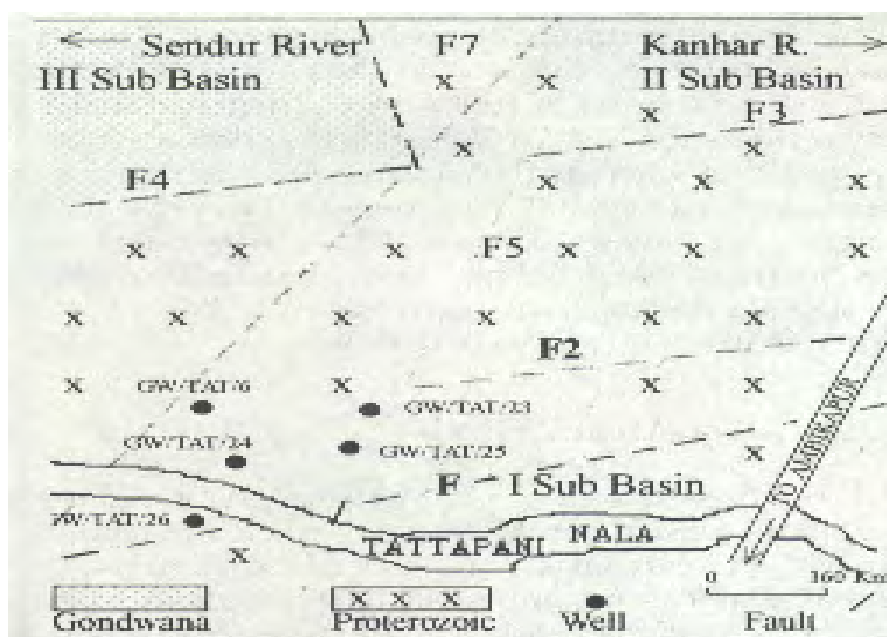
Fig. 1 above presents the geological and structural map. In general, as can be seen from the figure, the major geological formations are separated by ENE-WSW regional faults, which in turn are affected by a number of cross faults striking in NNW-SSE and NE-SW direction. Several faults are also observed towards south of hot spring near Balarampur and Lurgutta and are located within the Proterozoic sequence in the area (Ravishanker et al. 1987).

Table 1. Stratigraphic sequence of Tattapani area, Chattisgarh Basin, District Surguja (After Thussu et al, 1987).

Age	Formation	Rock Type
Recent		Soil/river alluvium
Quarternary		Hydrothermally altered clay
----- Unconformity -----		
Lower Tertiary to Upper Cretaceous	Deccan Trap	Dolerite sills and dykes intruding Gondwana sediments (near Jajawal)
	Gondwana Super Group (possibly Mahadeva)	Post Barakar brown to reddish brown sandstone showing current bedding and ripple marks and subordinate conglomerate, no coal seems
Mesozoic to Lower Permian	Barakar Formation	Sandstone and shale with grit bands, grey shale with plant fossils and coal seems
	Talchir Formation	Green splintery shale, sandstone with minor grit bands and conglomerates
----- Unconformity -----		
Proterozoic		Phyllite, graphitic at some places, Quarzite, Grey gneiss, Biotite schist, Actinolite, Remolite schist kyanite-sillimanite schist, Garnet gneiss, hornblende gneiss, granulite, Amphibolite, augen gneiss, diorite, Calcgranulite and pink gneiss.

Hydrology of the area

Geohydrological studies of the area clearly demarcate three sub basins (Fig. 2). Basin I and II showing flow of groundwater towards Kanhar river in easterly direction. The gradients of Basin III are towards west feeding Sedur river. Both the rivers flowing towards north ultimately feed the Son river. The thermal groundwater in Gondwana occurs in confined conditions while in Proterozoic rocks, under water table conditions. The meteoric water due to deep circulation collects heat and rises to the surface through conduits provided by highly fractured deep seated fault zones.



Discussions and conclusions

In view of the geological characters, geohydrological parameters and world analogy especially similarity to the Franceville Basin, Gabon, the District Surguja in India has become one of the favourable sites for the uranium mineralization due to the following favourable factors:

- Nature of basement rocks: The basement rocks mainly comprising mainly of Quartzite, Grey gneiss, Biotite schist, Garnet gneiss, hornblende gneiss, granulite, Amphibolite, augen gneiss, diorite, Calcgranulite and pink gneiss of Pro-

terozoic age contains traces of uranium. The basement rocks of Bengpal granite gneisses in the nearby area are known to have anomalous concentration of Uranium (2 to 102 ppm) which is available for mobilization (Chaturvedi 1998).

- Surrounding rocks: The Post Barakar Brown to reddish brown sandstone showing current bedding and ripple marks and subordinate conglomerate of Gondwana Super Group, Mesozoic to Lower Permian age are separated by an unconformity from the basement.
- Type of environment: The phyllites are mainly carbonaceous and graphites are associated with pyrite mineralization. The presence and arial extent of pyrite in the fractures as the hydrothermal alteration mineral in an area of about 2 km², indicating a reducing environment demarcates the limit of uranium mineralization in the area.
- Volcanic activity: Deccan Trap (Lower Tertiary to Upper Cretaceous) consisting of the Dolerite sills and dykes found intruding the Gondwana sediments.

The beds are also gently dipping (maximum 15⁰) and the groundwater movement is slow enough to deposit the uranium from water in the surrounding sandstone deposits of mainly the fluvial origin from the Gondwana Super Group. A higher concentration of uranium is yet to be traced which is expected in the area due to very favourable mineralization conditions. The area thus, represents a high potential and an ideal site for sandstone type uranium mineralization. The further work is in progress.

Acknowledgement

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References

- Chaturvedi S N, Saha A, Saxena V.P. (1998) Uranium potential for sandstone type deposits around NE part of the Proterozoic Abujhman Basin, Bastar District, Madhya Pradesh, India. Proc. Nat. Symp : Recent Researchers in Sedimentary Basin : 139-149
- Ravisankar, Thussu J.L, Prasad J M (1987) Geothermal studies at Tattapani hot spring area, Surguja District, Central India. Geothermics : 61-76
- Thussu J L, Prasad J M, Saxena R K, Prakash G, Muthuraman K (1987) Geothermal energy potential of Tattapani hot spring belt, Surguja, M.P. Rec. of GSI : 115, 30-35.

