DSPMU UNIVERSITY, RANCHI.
DEPARTMENT OF GEOLOGY

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URANIUM DEPOSITS OF JHARKHAND

The first uranium deposit (vein type) was discovered at Jaduguda in 1951 in the Singhbhum Shear Zone (SSZ), in the present state of Jharkhand (formerly part of Bihar state). Subsequently, over a period of many years, extensive exploration inputs in the SSZ has established it as an important uranium province. Presently, the notable uranium producing mines in the state are Jaduguda, Turamdih, Narwapahar, Bhatin and Banduhurang, Bagjata and Mohuldih located in SSZ (Figure-1).

The Singhbhum shear zone (SSZ), eastern India is well known for its uranium and copper mineralization along with several small apatite-magnetite deposits occuring along the shear zone.

The SSZ hosts seven presently-active uranium mines, some rich Cu- deposits with by-product of Ni, Mo, Te, and Au, and many small apatite-magnetite ore bodies. The known uranium deposits and occurrences along the shear zone are hosted by volcano-sedimentary rocks of the Singhbhum Group (SG), Dhanjori Group and to a lesser extent by Soda granite/feldspathic schist. Uraninite is the most abundant and ubiquitous uranium bearing ore mineral in the deposits of the SSZ along with traces of brannerite, davidite, pitchblende, allanite, xenotime, autonite, torbernite and uranophane. Insignificant, minor uranium occurrences are also reported in metabasic and ultrabasic rocks (epidiorite / amphibolite schist), but in general they are not mineralized.

1) Jaduguda- Jaduguda is the first mine in the country to produce uranium ore in a commercial scale. Jaduguda uranium deposit is located almost in the center of Singhbhum Thrust Belt (STB), Jharkhand. The deposit was discovered in 1951 when intensive prospecting was carried out in STB for radioactive minerals. In 1967, Uranium Corporation of India Ltd (UCIL) was formed with an objective to mine and process uranium ore to meet the nuclear fuel requirement of the country.
Since then, Jaduguda uranium mine is in continuous operation under UCIL.

General geology
Uranium mineralisation at Jaduguda is in the pre-cambrian metasedimentary rocks of Singhbhum shear zone and are structurally controlled by strike-slip shears of Singhbhum orogeny. The host rocks are autoclastic conglomerate (formed by crushing, fracturing and brecciation) and quartz-chlorite-apatite-tourmaline-magnetite schist in which uranium bearing fine grained uraninite minerals occur as disseminated grains and micro-veinlets. The associated accessory minerals found along with uranium are the sulphide minerals of copper, nickel & molybdenum and magnetite. The ore is amenable to direct leaching by acid with high percentage of recovery (Venkatraman et al., 1971).

Mineable mineralisation at Jaduguda is confined to two principal lodes extending as veins following the general trend of the schistosity. Persistence of lodes is fairly uniform both along strike and dip with an average inclination of about 40°. The lodes are separated from each other by a distance of about 80m. Footwall and hangwall side rocks of both the uranium lodes are quite competent from geo-technical point of view.

2) Turamdih- The Turamdih uranium deposit is one of the very important low grade deposits in the Singhbhum shear zone. Besides uranium, magnetite has been recovered as byproduct of uranium mining and the deposit also contain high grade copper ore.

General geology
The Turamdih U–Cu (–Fe) deposit is located in the central segment of the SSZ. The rock types in and around the Turamdih uranium deposit consist of chlorite schist, sericite schist, quartzite and

feldspathic schist. The chlorite schist and sericite schist comprises variable proportions of quartz, chlorite and sericite. Discontinuous bands of quartzite are commonly ferruginous with alternating bands of quartz and hematitized magnetite. The feldspathic schist is composed predominantly of quartz and albite with subordinate chlorite, sericite, and biotite. The rocks show prominent mylonitic shear foliation which parallels the schistosity defined by oriented chlorite and sericite (Pal et al., 2009). Superposition of later generations of folds on the sheared host rocks produced local dome and basin structure in the ore lodes (Sarkar, 1984). The common sulfide ore minerals are chalcopyrite and pyrite and uranium mineralization is represented mainly by uraninite, minor pitchblende and davidite. Within this area, uranium occurs in different rock types as small lodes that parallel the regional foliation, principally as lens shaped bodies of 1.5 to 40 m thick and 50 to 600 m long (Pal et al., 2009). The uranium ore bodies are variably deformed resulting in folding and thickening of ore bodies (Mohanty and Verma 1989; Pandey et al. 1994). The ore body morphologies suggests that most of the mineralization at Turamdih is pre-/early shearing with later redistribution during deformation.

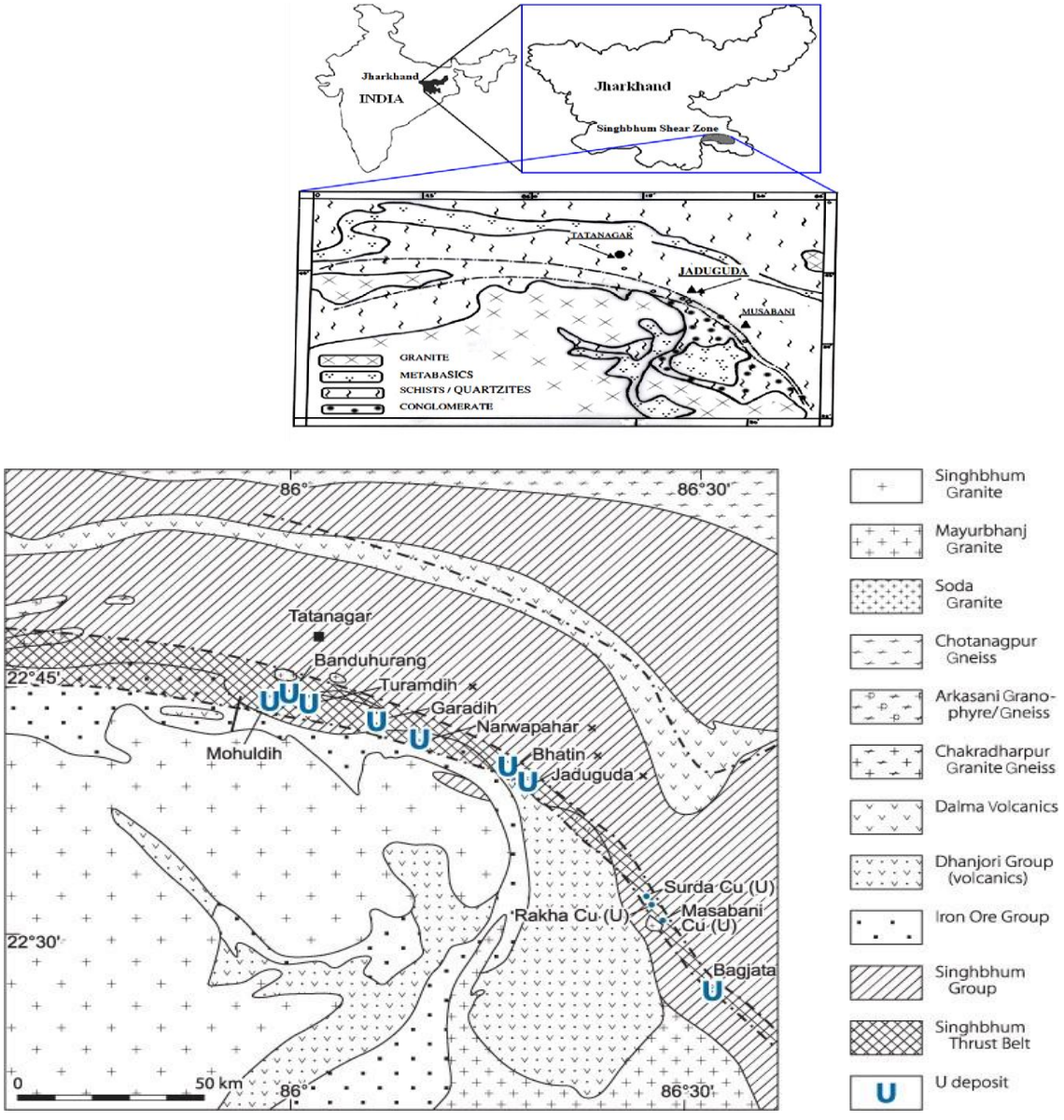

Figure-1

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3) Bhatin Mine- Bhatin is a small uranium deposit situated 3 km west of Jaduguda. Geological settings, mineral assemblages and other host rock characteristics in this deposit are similar to those of Jadugdua deposit.

4) Narwapahar Mine- It is a large deposit located 12 km west of Jaduguda. This mine was commissioned in 1995. Narwapahar mine is one of the most mechanized underground metalliferrous mines in India and has been developed up to a depth of 380 m.

General geology

The mineralisations thrust zone in Narwapahar is believed to be between Chaibasa stage of rocks (Mica schist and phyllites) and phyllites of Iron Ore stage. There is very little lithological difference between the rocks of the two stages in this area. This lithological similarity of the rocks makes their division into the different stages difficult. Along with mineralisations the rocks have been chloritised and biotitised and this zone of biotitised and chloritised rocks in Narwapahar is very wide. This indicated that the zone of shearing is comparatively wider in Narwapahar than further east along the shear zone.

The rock types in Narwapahar are essentially chlorite and Biotite Schists but in most places chlorite predominates. There is sericite, apatite and magnetite in addition to uranite and pitchblende in the mineralized zone. The foliation strike of the rocks is generally NW-SE with the following dip to the N.E. The Narwapahar hill proper is made of Dhanjori quartzite and zone of thrusting is along the northern foot hill represented by chlorite and Biotite Schists. The main regional structural feature is the major over-fold, the axial plane of which is parallel to the foliation strike of the rocks. The axial plane shears along which the mineralisation has taken place are also parallel to the foliation strike of the rocks. Apart from this there are certain cross – folds, whose axial planes are almost at right angles to the regional strike of the rocks. These superposed folds or cross-folds are probably subsequent to the mineralisations.

5) Banduhurang- Banduhurang uranium deposit is located about 6 km south of Tatanagar railway station.

General geology

The mineralisation in Banduhurang falls within Singhbhum Thrust Belt. Uranium mineralsation is confined within chlorites and felsparthitic-chlorite schist while the sericite quartz schist is devoid of any radio-activity and appear to act as footwall marker horizon of mineralisation.
The general strike of ore body is almost east-west with a variable dip. In the western part of the deposit, the dip of ore bodies varies between 60° to 70°due north, whereas the central and eastern part of deposit shows gentle dip of the order of 10° to 20° due north.

6) Mohuldih-It is located 5 km west of Turamdih. The host rock is tourmaline bearing quartz schist, quartzite and chlorite quartz schist. Mineralisation is established over 1 km strike length and within a vertical depth of 250 m. Mining by UCIL has commenced from April 2012.

7) Bagjata-It is located nearly 25 km southeast of Jaduguda. Uranium mineralisation is hosted by quartz chlorite biotite schist. The mineralisation is spread over 450 m strike length with a vertical persistence of 260 m. Mining by UCIL has commenced in 2008.