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WATER AND FOOD SECURITY OF THE CENTRAL INDIAN CRATON

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ABSTRACT

Water and food security have become major issues in the world today. With ever increasing population, the per capita availability of natural resources like land and water is shrinking fast. Therefore, identification and utilization of comparatively efficient system through proper investigation are significant. In the present paper an effort is made to evaluate the comparative groundwater potential within the Central Indian Craton for food and water security. The cratonic area based on study has been classified into three categories. The basin rock area of the craton is endowed with best land and ground water condition for agriculture, irrigation and drinking water purpose. Proper management of natural resources like land and water in this area and similar areas in other cratons can be crucial for futuristic strategies for water and food security.

INTRODUCTION

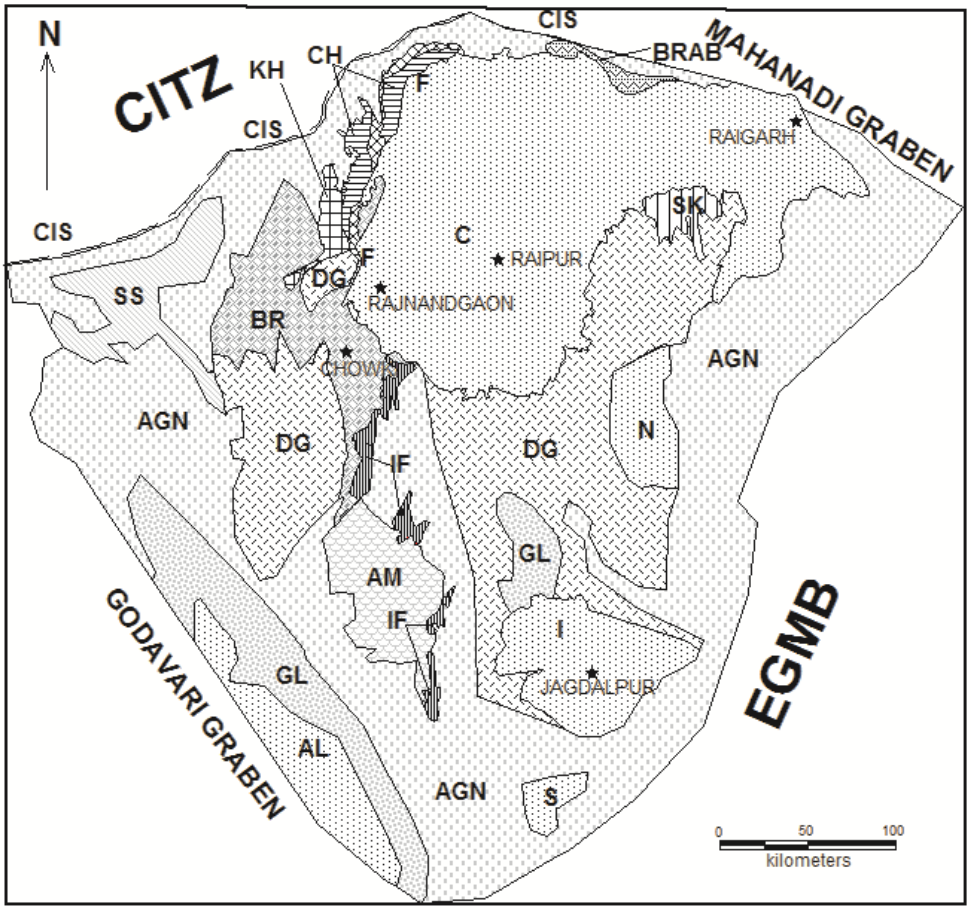
World over the water and food security have become major issues today. Predictably, India will be the highest population nation in near future. Whereas India is presently house of 17 percent of the world population but having only 2.6 % land and nearly 4% of renewable water recourses of earth. The global changes in climatic conditions have further complicated the scenario. It is therefore imperative and essential that our national water and food security plan should be meticulous and scientific. This must provide the requisite confidence to the nation for a sustainable growth. Achieving this is largely dependent on reliable scientific data base of all related aspects. With ever increasing population, the per capita availability of natural resources like land and water is shrinking fast. Therefore identification of comparatively efficient system through proper investigation can be significant contribution. The present communication is an effort to identify comparative potential of food and water security means within the area of investigation. The Study area, i.e. Central Indian Craton is one of the water stressed area of country. The area is largely drained by Mahanadi River and Godavari River system and receives around 1200 mm of average rainfall, mostly through SW monsoon. However the population in the Central Indian Craton and are heavily dependent on groundwater resources for water and food security.

METHODOLOGY

To workout the comparative potential for food and water security within the Study area- Central Indian Craton, the geological maps of the Geological Survey of India [1] have been used to group the geology according to age and similarity of petrological characters. The geomorphological layer and soil layer of the area prepared based on NRSA data and soil map of NATMO respectively. The ground water exploration data of CGWB [2,3,4,5] for the Central Indian Craton superimposed over the geology, soil and geomorphology layer in a GIS platform. The data so obtained were analysed to classify the craton area into three distinct categories.

RESULTS AND DISCUSSIONS

The Central Indian Craton (CIC; [6]), also known as the Bastar Craton [7] or the Bhandara Craton [8], in Peninsular India occupies nearly 160000 km^2. It includes entire lower half of Chhattisgarh State, SW parts of Orissa, parts of northern Andhra Pradesh and eastern part of Maharashtra. The CIC is bounded by two mobile belts – the Central Indian Tectonic Zone (CITZ; [9]) and the Eastern Ghat Mobile Belt (EGMB) in NW and SE respectively. Mahanadi and Godavari grabens surround the CIC in NE and SW respectively (Fig.1). CIC is adjacent to the Dharwar Craton in south, Singhbhum Craton in northeast and Bundelkhand Craton in northwest. The CIC comprises mainly Archaean and Proterozoic rocks. Archaean rocks include Sukma (Bengpal) gneiss-granitoids, metasediments, Bhopalpatnam, Kondagaon and Balaghat granulites, the Bailadila Iron Formation, Amgaon Group of rocks etc .Proterozoics in CIC include rocks of Dongargarh and Kotri Supergroup including Dongargarh- Malajkhand and equivalent granitoids, Sauser and Sonakhan Group of rocks and platform sediments of Purana basins [10]



CITZ- Central Indian Tectonic Zone
EGMB- Eastern Ghat Mobile Belt
CIS- Central Indian Suture
AGN- Areachean gneiss including Amgaon Group
GL-Granulites
IF- Bailadila Iron Group
BRAB- Bilaspur- Raigarh metamorphic belt
SS- Sausar Group
SK- Sonakhan Group
AM- Abujhmar Group
BR- Bijli Rhyolite
DG-Dongargarh granite and equivalent
KH- Khairagarh Group
CH- Chipli Group
C- Chhattisgarh basin
I- Indrvati basin
N-Khariar basin
S- Sukma basin
AL- Albama basin
Intercratonic basins
F- F-Fault line

Fig 1. Geological setup of the Central Indian Craton.

The Central Indian craton area therefore is predominantly occupied by cratonic and inter-cratonic basin rocks with little or no cover sediments. The crystalline rocks of craton have been divided into two provinces based on hydrogeological character. The inter-cratonic basins form the third province (Table-1). The first province is covering the largest area is widely spread over the craton comprising metamorphic rocks. The intrusive and extrusive crystalline rocks form the second province and occupy the smallest area . The third province presents the inter cratonic basins which are termed as basin rocks in this paper. The inter cratonic basins are dominated by karstic calcareous and argillo-calcareous rocks with lesser amount of orthoquartzite. Owing to the petro-mineralogical composition and geological structure of basin rocks thus form the morphological plains , whereas the cratonic rocks form hills, valley, plateaus and plains with slopes and pediments (Table-1). The soil map depicts that basin rocks have predominantly produced the vertisol against the alfisol of cratonic rocks (Table-1). Vertisol are rich in plant nutrients and are favourable for rice cultivation.

Table-1. Categorization of geology, geomorphology and soil in Central Indian Craton

Stratigraphy with rock type	Category With area	Geomorphology	Soil

Chhattisgarh Supergroup, Indravati, Sukma and Khariar Albaka Group	Raipur Group- predominantly calcareous and argillo-calcareous karstic rocks, Chandarpur Group-essentially arenaceous with some argillaceous rocks, Singhora Group- arenaceous with argillo-calcareous karstic rocks. Tiratgarh and Cherakur Fm. are arenaceous and argillaceous rocks, Kanger and Jagdalpur Fm predominantly calcareous and argillo-calcareous karstic rocks,	Cratonic **Basin rocks** (45400 km^2) 29%	Arenaseous rocks forms high land plateaus and escarpments, the calcareous and argillo-calcareous karstic rocks forms plains	Predominantly Vertisol followed by Ultisol
Dongargarh Supergrou, Abhujhmar, Group	Plutonic-volcanic of Nandgaon Group granite, rhyolite, andesite, basalts, dolerite and meta sedimentary rocks of Chilpi, Khairagarh Groups quartzite, shale-slate and carbonates	Cratonic rock – **Class 1** (38800 km^2) 24%	Pediment and pediplains, , Structural hills and valley, plateaus with denudational slop	Predominantly Alfisol -red loamy soil
Bengpal Group Archaean Gneissess, Sauser Bailadila and Sonakhan Group	Granulites, Bastar - Sambalpur gneisses , Bilaspur- Raigarh- bel, meta sedimentary , iron ore rocks , basement crystalline and gneisses	Cratonic rock – **Class 2** (74625 km^2) 47%	Mainly Structural and residual hills and valleys, denudational slop with pediment and pediplains	Predominantly Alfisol -red sandy soil

During prolonged summer the weathered zone developed over both terrain forming phreatic aquifer are subject to crisis of sustainability. Open wells tapping the unconfined aquifer are generally larger in diameter in cratonic rock than basin rocks, hence are costly and less stable. In basin rocks (Fig.2) the rate of construction of successful bore well, its productivity and sustainability is comparatively higher than cratonic rocks. The yield potential of aquifer in cratonic rock ranges from <1 to16 lps, out of which nearly half of the exploratory well drilled are having < 1 lps discharge. The yield in basin rocks yield varies from <1 to 40 lps where only 25% wells are having <1 lps discharge and >50% well are having discharge between 3 and 40 lps. Even when cratonic rocks are covered with small thickness of basin rock it converts the cratonic rocks into more productive unit. The ground water quality of the basin rocks are more predictable and safe from geogenic contamination than cratonic rock, which have highly variable discharge and often contains dangerous fluoride, arsenic (Table-2). The basin rocks mostly produce high TDS and sulphate, the source of temporary or permanent hardness.

Table 2. (**ndian Craton**

Category	**Water quality hazards**
Cratonic **Basin rocks**	High SO_4 in parts of Raipur Group covered area
Cratonic rock – **Class 1**	High Arsenic and Fluorite along Kotri lineament
Cratonic rock – **Class 2**	High Fluorite in parts of Dentewara Balaghat and Raigarh district

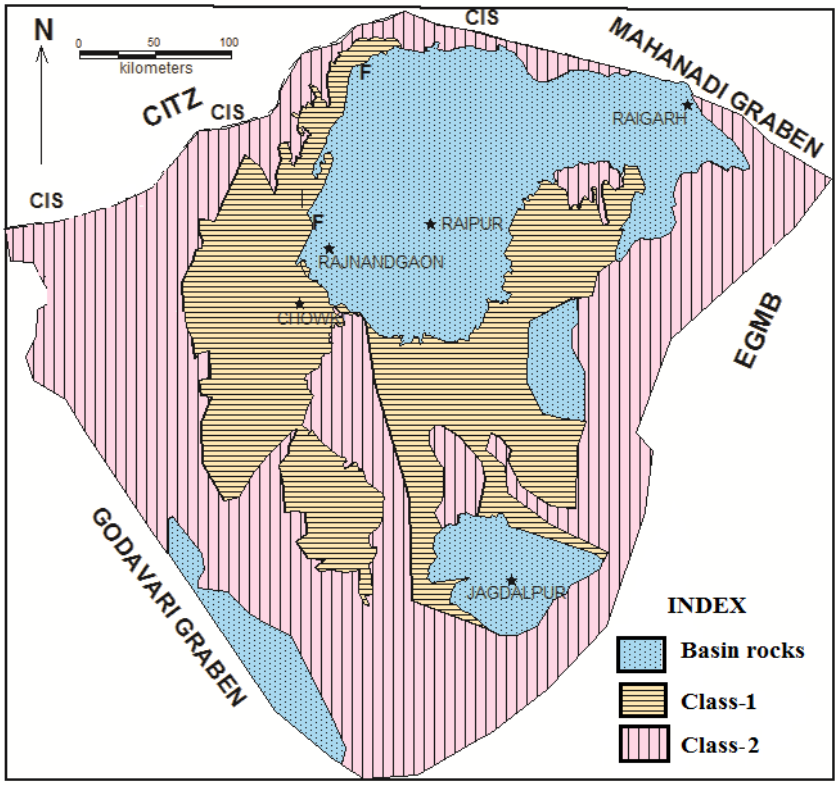


Fig 2. Comparative categorization of the Central Indian Craton (as per the table1&2**).**

Integrating all the parameters under study shows basin rocks of the CIC form plain land, having vertisol with higher permeability and yield potential, better water quality can be considered as better prospect and need to have separate scientific plan of management for effective and efficient utilization of comparatively better opportunity of water and food security for its sustainable development. The study also establishes need for different management strategy as per the soil, land and water availability of a specific area. The study carried out in CIC can be replicated in other six ctatons of India. Identification of potential areas and their utilization in other cratons can be significant for futuristic strategy for water and food security of the country.

CONCLUSION

The above discussions clearly establish that the basin rocks, of the Central Indian Craton are endowed with best land and ground water condition for agriculture, irrigation and drinking water purpose. The other two provinces of cratons are having lower ground water potential, hence are comparatively less conducive.

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