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Новая схема тектонического районирования Бунделкхандского кратона Индийского щита

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Аннотация. Бунделкхандский кратон Индийского щита подразделяется на три террейна: Центрально-, Северно- и Южно-Бунделкханский. Тектоническое районирование выполнено на основе анализа особенностей развития земной коры каждого из них, а также глубинного строения кратона. Последнее получено по результатам магнито-теллурического зондирования. Центрально-Бунделкханский террейн сложен палео-неоархейскими гранитоидами тоналит-трондьемит-гранодиоритовой (ТТГ) серии, мезо-неоархейским зеленокаменным комплексом, в меньшей степени микроклиновыми гранитами. Его земная кора выделяется относительно низким удельным сопротивлением и мощность около 60 км. Северо-Бунделкханский террейне сложен преимущественно неоархейскими микроклиновыми гранитами, санукитоидами, монцогранитами, редки фрагменты ТТГ и мафитов. Земная кора этот террейна выделяется в виде однородого блока с высоким удельным сопротивлением и имеет мощность около 65-70 км. Южно-Бунделкхандский террейн сложен, главным образом, также микроклировыми гранитами, но здесь идентифицируется присутствие палеоархейских ТТГ, обычны архейские мафит-ультрамафитовые интрузии, сланцевый пояс, единичные массивы неоархейских санукитоидов. Земная кора этот террейна имеет трехчленное строение и мощность около 60 км.

Ключевые слова: архей, тектоническое районирование**,** Бунделкхандский кратон, Индийский щит.

The new tectonic division of the Bundelkhand Craton, Indian Shield

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Abstract. The Bundelkhand Craton of the Indian Shield is divided into three terrains: Central, Northern and Southern Bundelkhand. The tectonic division is based on analysis of the crustal evolution and deep structure of each terrain. Analysis of the deep structure is based on the results of magnetotelluric studies. The Central Bundelkhand terrain consists of Paleo-Neoarchean tonalite-trondhjemite-granodiorite (TTG) granitoids, a Meso-Neoarchean greenstone complex and lesser K-rich granites. It's approximately 60 km thick earth crust displays relatively low resistivity. The North Bundelkhand terrain consists dominantly of Neoarchean K-rich granites, sanukitoids and monzogranites; TTG and mafic rock fragments are scarce. The 65-70 km thick earth crust of this terrane is a homogeneous high-resistivity block. The Southern Bundelkhand terrain consists mainly of K-rich granites and smaller quantities of Paleoarchean TTG; Archean mafic-ultramafic intrusions are common; a schist belt and scarce Neoarchean sanukitoid massifs occur. The Earth crust of this terrain consists of three units and is about 60 km thick.

Key words: Archean, tectonic division**,** terrain, Bundelkhand Craton, Indian Shield.

Introduction

The Indian Shield consists of several segments of Archean cratons, i.e. Bundelkhand-Aravalli, Dharwar, Bastar, and Singhbhum cratons (Fig. 1 a). The ENE–WSW trending Central Indian Tectonic Zone (CITZ) or the Narmada Son Lineament is a major lineament, which separates the Dharwar, Bastar, Singhbhum cratons as a southern block (Ramakrishnan and Vaidyanadhan, 2010). The northern block, consisting of the Aravalli and Bundelkhand cratons, is also divided by the NE–SW trending Great Boundary Fault to the west and the east, respectively (Ramakrishna and Vaidyanadhan, 2010; Roy, Purohit, 2018).

The Bundelkhand Craton has long been considered as a big granite massif with other rock inclusions alienated along the Bundelkhand Tectonic Zone form two areas (Ramakrishna & Vaidyanadhan, 2010). First time, Singh & Slabunov (2015) illustrate that it is much more similar structurally to other cratons than it was assumed before, but the contribution of Neoarchean K-rich granitoids is considerable. The new

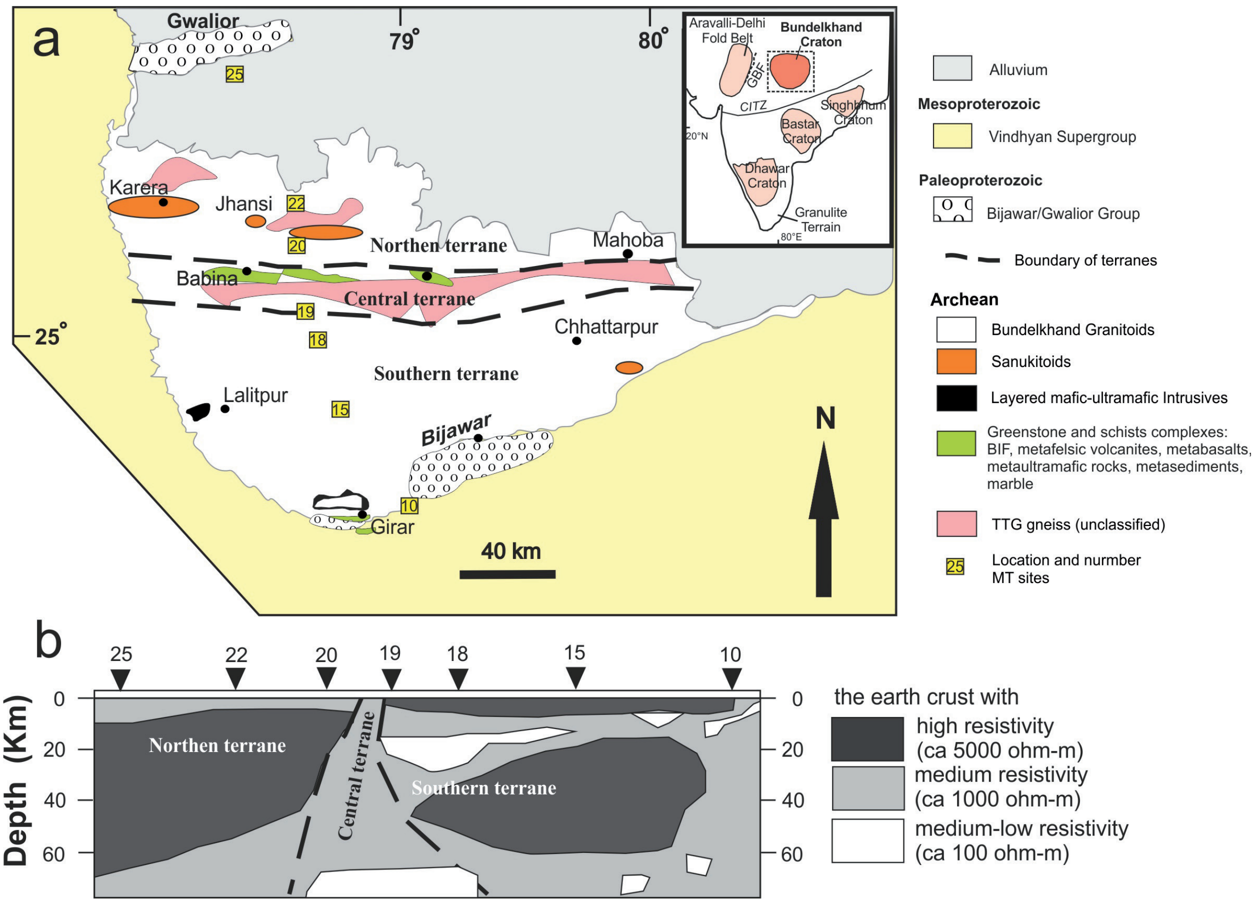

Fig. 1. (a) Map showing the tectonic division of the Bundelkhand Craton (compiled using: Singh & Slabunov, 2015; Slabunov & Singh, 2018; Slabunov et al., 2018; Joshi & Slabunov, 2019), the inset shows the cratonic blocks of the Indian Shield (Ramakrishna and Vaidyanadhan, 2010); (b) scheme of the deep crustal structure of the Bundelkhand Craton along the profile indicated in Fig. 1 a by dots from 10 to 25 (modified after Gokarn et al., 2013).

Рис. 1. (a) Схема тектонического районирования Бунделкхандского кратона (составлена с использованием: Singh & Slabunov, 2015; Slabunov & Singh, 2018; Slabunov et al., 2018; Joshi & Slabunov, 2019; Singh et al., 2019a), на врезке показаны кратоны Индийского щита (Ramakrishna and Vaidyanadhan, 2010); (b) схема глубинного строение земной коры Бунделкхандского кратона кратона по профилю обзоначенному на рис 1 а точками от 10 до 25 (на основе: Gokarn et al., 2013).

geological data on the Bundelkhand Craton and its deep crustal structure, published in the past few years (Slabunov & Singh, 2018; Singh et al., 2019 a) and based on magnetotelluric sounding (Gokarn et al., 2013), provide a basis for the tectonic division of the craton and recognition of the Central, Northern, and Southern Bundelkhand terraines.

Terrains of the Bundelkhand craton

The Central Bundelkhand terrain, composed mainly of granite–greenstone complexes, occurs in the Babina-Mauranipur-Mahoba area (Fig. 1a; Mondal et al., 2002; Saha et al., 2016, Singh & Slabunov, 2015; Kaur et al., 2016; Verma et al., 2016; Slabunov & Singh, 2018). They comprise Paleo-Neoarchean TTG, Paleoarchean oceanic rocks (Singh et al., 2019b), Meso-Neoarchean greenstone rocks, and a Neoarchean granodiorite-granite suite (Singh et al., 2019a). The greenstone rocks occur mostly in the Babina and Mauranipur belts, with an E–W strike direction known as Bundelkhand Tectonic Zone (Ramakrishna & Vaidyanadhan, 2010). These belts are composed of a Mesoarchean (ca. 2.81 Ga) sequence of mafic to ultramafic lava, felsic volcanics, metasedimentary rocks (BIFs) and Neoarchean felsic volcanics (lava and dykes) (Singh & Slabunov, 2015 a, 2016). There are fragments of Paleoarchean oceanic mafic-ultramafic rocks here (Singh et al., 2019b). Neoarchean (2542 ± 17 Ma) felsic volcanics (lava) in the Babina belt show a Sm–Nd model age of 3.14 Ga; it means that these rocks are contaminated by the existing older crust (Singh & Slabunov, 2015). The 2557±33 Ma felsic volcanics (dykes) in the Mauranipur belt (Slabunov & Singh, 2018) also show their mixing with Mesoarchean rocks as they contain inherent zircons there. K-rich granitoids cut TTG and greenstone belts and commonly form big massifs (Singh & Slabunov 2015; Singh et al., 2019a). Local positive gravity anomalies in the Central terrain are clearly correlated with mafic-ultramafic rocks from the Central Bundelkhand greenstone complex (Gokarn et al., 2013), which have a thin surface cover with K-rich granitoids. The results of magnetotelluric sounding show that the Earth crust of the Central Bundelkhand terrain (Fig. 1 b) is a narrow ~20-25 km thick zone with relatively low resistivity over the entire thickness of about 60 km (Gokarn et al., 2013). The 200 km long E-W trending central terrane is a major structural feature in the craton, which stretches from Babina to Mahoba via Mauranipur and apparently divides the Northern and Southern terrains.

The Northen Bundelkhand terrain, located north of the Central Bundelkhand granite–greenstone terrain (Fig. 1a), consists mainly of K-rich granites with a visible contribution of sanukitoids (Joshi et al., 2017), monzogranites and granodiorites. There are big strongly deformed orthoamphibolite (metagabbro) bodies also exist in this terrain have cross-cut relation with K-rich granitoids. They make up the bulk of the 2577–2560 Ma sanukitoids massifs situated in this part of the terrain (Joshi et al., 2017; Singh et al., 2019 b). The porphyritic micromonzonite-granite massifs occur as subvolcanic-plutonic rocks in this terrain (Singh et al., 2019 a). Magnetotelluric sounding has shown that the Northern Bundelkhand terrain (Fig. 1b) is a homogeneous block with high crustal resistivity to a depth of 65-70 km (Gokarn et al., 2013). It has a well-defined boundary with the Central Bundelkhand terrain.

The Southern Bundelkhand terrain consists mainly of Neoarchean K-rich granitoids with a minor volume of a schist complex, TTG, sanukitoids and mafic-ultramafic layered intrusion (Fig. 1a). The Girar schist (metasedimentary) belt consists of two groups of rocks: (i) quartzite, (ii) BIFs, minor amount of dolomitic marble and chlorite schist lenses exist near the quartzite/BIF boundary (Singh & Slabunov, 2016; Sabunov et al., 2017). The quartzites display low-grade metamorphism of fuchsite- and hematite- bearing quartz arenite with thick meta-argillite (schist) laminae and lesser quartz pebble conglomerates (Singh & Slabunov, 2016). BIF consists of thick-bedded quartz and hematite with magnetite. The quartzites of the Girar schist (metasedimentary) belt consist of 3.43 and 3.25 Ga detrital zircons which evident for the oldest granitoids (may be TTG) occur on this terrain (Slabunov et al., 2017). The southern terrain exposes a large intrusion, presumably a lopolith, known as the Ikauna complex (Slabunov et al., 2018). These mafic-ultramafic rocks lie among the Archean rocks of Bundelkhand granitoids, which apparently cut them, showing the lower levels of their age as Archean. This intrusion indicates the influence of a mantle plume on the continental crust. The Girar metasedimentary belt was apparently formed at that time. A low-gravity field in the central part of the Southern terrain (Gokarn et al., 2013) predetermined by the big role of K-rich granitoids here. Magnetotelluric sounding has shown that the Earth crust of the Southern Bundelkhand terrain consists of three units (Fig. 1b): a thin upper unit, a thick lower unit with high resistivity and a low resistivity zone (Gokarn et al., 2013). The Earth crust of this terrain is slightly thinner (about 60 km) than that of the northern terrain.

Conclusions

The Bundelkhand craton can be subdivided into the Central, Northern, and Southern Bundelkhand terranes on the basis of the combination of its main complexes (TTG, greenstone complexes, mafic-ultramafic, sanukitoids, monzogranite and high-K granites) (Fig. 1a) and the geophysical characteristics (Gokarn et al., 2013). All the terranes display a singular crustal architecture, evolution and geological structure.

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