

Quest for a Geologic Heritage

Girija Prasad Mohapatra

Former Additional Director General, Geological Survey of India

Plot 939, K8, Kalinga Nagar, Bhubaneswar 751003

Abstract: The Athgarh Sandstone, a Lower Cretaceous fluvialite / lacustrine deposit near Bhubaneswar, forms a significant part of the Upper Gondwana sequence in the Mahanadi Basin. This sandstone is intruded by a dolerite dyke, dated to 109 ± 2.6 Ma. Despite its geological importance, the exposure along the southern bank of the Mahanadi River is increasingly at risk due to anthropogenic activities. A thorough investigation is necessary to trace its continuity and preserve this site for its valuable geo-heritage significance.

Key Words: Athgarh Sandstone, Dolerite Dyke, Raajmahal Trap, Upper Gondwana

Introduction

On January 24th, 1977, I was in New Delhi for the Personality Test of the Geologist Examination, conducted by UPSC—a new test introduced that year. A friend from JNU arranged accommodation for me and also a black coat from one of his friends from Odisha. It was my first time wearing such formal attire as a fresh post-graduate in geology. During the interview, a professor from Kolkata asked me about the basic dyke of Naraj, a geologic feature that occurs where the Kathajori River branches from the Mahanadi. I had to admit I did not know much about the Naraj Dyke, a unique geological occurrence near the city of Cuttack, where I completed my post-graduation in Geology. Despite this gap in my knowledge, I succeeded in the UPSC exam, ranking among the top fifteen. But the unanswered question at UPSC interview lingered in my mind, inspiring me to explore the dolerite dyke near Cuttack.

Geological Background

As per the available literature, the Naraj dolerite dyke intrudes the Athgarh Sandstone of the Lower Cretaceous period (145 to 100.5 million years ago). This sandstone constituting part of the Upper Gondwana litho-sequence comprises significant fluvialite and lacustrine sediments first reported by Blanford in 1856. The Athgarh sandstone was used in construction of 7th Century to 15th Century historical temples of Bhubaneswar that are unique for their architectural, marvels which includes the famous Lingaraj Temple (10-11th Century) and many more. The Khandagiri-Udayagiri cave complexes of 1st -2nd Century BC are also carved within the Athgarh Sandstone. The Athgarh Formation is intruded by a rare dolerite dyke near Siddheswar Temple atop a hill on the bank of Mahanadi. Professor S. Acharya and others have reported the occurrence of the intrusive body in 1965 and 1969. More over the age of the dolerite dyke by K-Ar method is reported to be 109 ± 2.6 Ma (Agarwal and Rama, 1976) indicating a relationship with events of Rajmahal Trap.

The geological finding was around a small hillock with a temple known as the Sidheswar Temple, dedicated to Lord Shiva, on the bank of river Mahanadi near the village Naraj in Cuttack District (Photo-1) and nearly 30 kilometres from the capital city of Bhubaneswar. Situated on the banks of the Mahanadi atop a hill, ($20^{\circ} 27' 48''$ N $85^{\circ} 45' 25''$ E) the site is notable for its ~3m thick lateritic capping derived from and resting on the Athgarh sandstone. The small hill, a spur in the river's flow, requires protection from riverine erosion.



Photo – 1



Photo - 2

Field trek

My longstanding desire to explore this site for its geological significance was delayed due to various commitments. However, in June 2024, the Institute of Geoscientists, Odisha approved my proposal for a field visit with researchers and students. The monsoon is usually active after mid-July. We planned the visit for July 16th. Four retired geologists, including Dr. Manoranjan Mohanty, Jayanta Kumar Nanda, Jadaba Nanda Das, and myself, embarked on this journey, driving from Bhubaneswar to Naraj.(Photo 2 and 7). We arrived by 10:30 AM and climbed about 110 steps to the Sidheswar Temple atop the hill (Ph-2), approximately at a height of 100 metres from the riverbank. The temple, built in the Kalingan “Rekha Deula” style, lacks the intricate carvings typical of historical temples of Bhubaneswar. (Photo-3) The recent laterite cuttings for the expansion of worship area around the temple have a smooth vertical face of a height of 5m or more (Photos- 4 and 5). Dense monsoon vegetation prevented us from accessing the riverbank, leaving little geological insight at the temple itself. J.K. Nanda visited this locality in 1967 as a student with Profs. S. Acharya and P. Ray of Ravenshaw College. The mafic dyke was mined in the 70’s for road and construction material. Shri Nanda made a field visit to this area with GSI Trainee Officers in March 2015 by which time the mining of the mafic intrusive body had stopped possibly to prevent damage to the temple on the hillock. Our search for the intrusive body was based on his recollection of previous mining history. Since, descending the hill to the river bank from the temple site was not practicable at this period we attempted to reach the river bank through Naraj village, and taking the road through an underpass below the railway line. We trekked on foot along a path between the hillocks and the Mahanadi both aligned NE-SW at that place.

Along the way, we observed a small farm developed by one Mr. Agarwal, who was trying to cultivate organically despite limited success. This farm is called as black coal river bank farm in Google map. Our attempt to reach the base of the hillock was futile due to monsoon undergrowths. However, we could locate a steep but smooth scarp face comprising carbonaceous shale (Photo 6, 7) which is confused to be black coal locally. This carbonaceous shale is the storehouse of Upper Gondwana plant fossils and has been investigated by several geoscientists. After a two-kilometre trek, we reached the eastern side of the Siddheswar spur, protected by an artificial embankment. This embankment as a preventive measure for arresting bank erosion has been constructed very recently with boulders of charnockite transported from elsewhere.



Photo -3



Photo -4



Photo -5



Photo -6



Photo -7

Conclusion

A few scattered dolerite boulders could be located in the scree zone at the base of the escarpment. Mr. Agarwal also showed us rounded dolerite cobbles and pebbles from the foothill, but their source could not be confirmed. We were left wondering if the dyke had been lost to human activity or natural changes. It could have been mined away, buried, or otherwise obscured. The elusive dolerite dyke in the Athgarh Sandstone remains a potential geological heritage site, awaiting future exploration. With plans for another visit in January or February, we hope to uncover this geological heritage.

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