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Review

Lead distribution in coastal and estuarine sediments around India

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ABSTRACT

This study describes the geochemical distribution of lead (Pb) and identifies the critical factors that significantly control Pb distribution and speciation in coastal and estuarine sediments around India by using published data from the literature. Crustal sources influence the abundance of Pb in coastal sediment from the south-east and central-west coast of India. Parts of north-east, north-west, and south-west coast of India were polluted by Pb. Distribution of Pb in sediments, from the north-east and north-west coasts of India, were controlled by Fe–Mn oxyhydroxide mineral phases of the sediments. However, organic carbon (OC) seemed to be a dominant factor in controlling the distribution of Pb in sediments from the central-east and south-west coasts of India. The outcome of this study may help in decision-making to predict the levels of Pb from natural and anthropogenic sources and to control Pb pollution in coastal and estuarine sediments around India.

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1. Introduction

Dissolved lead (Pb) is quickly scavenged by negatively charged solid surfaces like clays, carbonates, oxides and hydroxides of Fe,

Mn as well as organic carbon (OC) in water column. As a consequence, non-chelated or dissolved Pb has a short water-column residence time in marine environments. Settling of Pb associated particulate matters usually control the distribution of Pb in a particular ocean basin. However, total concentration of Pb in coastal/estuarine sediments does not provide useful information about its speciation, bioavailability and geochemistry in the

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system. Quality and quantity of different metal binding ligands present in coastal sediments has been reported to control physicochemical forms of metals in the system (Chakraborty et al., 2015, 2014a,b,c, 2012a,b; Chakraborty, 2012). In coastal sediments, Pb can be present in different physicochemical forms (water soluble and exchangeable Pb complexes; Pb associate with carbonates phase; Pb bound to oxyhydroxide of Fe and Mn; Pb bound to organic matter and sulphides, etc.). Distribution of Pb in different binding phases of sediment has been used to understand Pb-geochemistry in a sediment system. There are very few speciation studies have been performed in coastal sediments to understand Pb-geochemistry in the system. However, several studies have been carried out to understand the distribution of total Pb content in coastal sediments around India over the last few decades; nevertheless, the information is quite limited and discrete

to understand Pb distributions and their geochemistry in the coastal sediments.

Pb has been reported to have different affinities for different binding-phases of coastal sediments. It has been reported that carbonate phase in coastal sediments plays a key role in controlling Pb distribution (Fulghum et al., 1988) in sediments. Scavenging property of Pb by Fe/Mn oxyhydroxide phase in sediment has also been identified as an important process in controlling speciation and geochemistry of Pb in sediments system (Jones and Turki, 1997; Tessier et al., 1979). Organic binding phase has been reported to control Pb distribution and its speciation in coastal sediment (Chakraborty et al., 2011, 2012a,b; Krupadam et al., 2007). However, poor correlation between Pb and sedimentary organic matter (SOM) has also been reported by Abaychi and Douabul (1986).

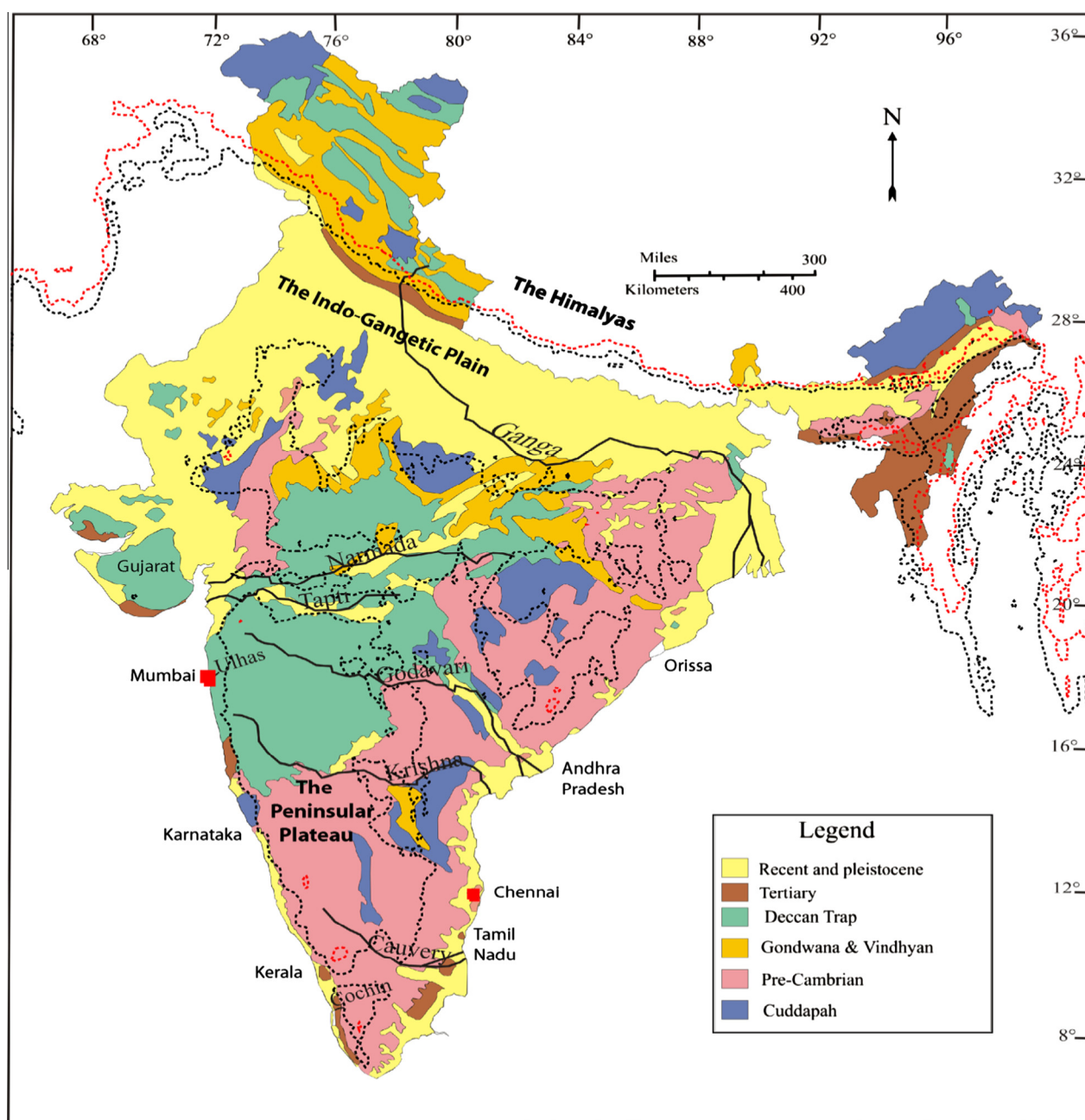


Fig. 1. Geological map of India with the studied areas.

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