Acta Geologica Sinica (English Edition), 2019, 93(supp.2): 10–11

Late Cenozoic Volcanic Rock and Associated Laterite Type Bauxite Deposits in Southeast Asia

CHEN Xifeng*, YE Jinhua and CHEN Xiufa

Development and Research Center，China Geological Survey, Beijing 100037

Citation: Chen et al., 2019. Late Cenozoic Volcanic Rock and Associated Laterite Type Bauxite Deposits in Southeast Asia. *Acta Geologica Sinica* (English Edition), 93(supp.2): 10–11.

1 Introduction

The Southeast Asia region have eleven countries, includes Myanmar, Cambodia, Indonesia, Thailand, Vietnam, Laos, Malaysia, Philippines, Brunei, East Timor and Singapore, and is endowed with a diversity of mineral resources (Khin Zaw et al., 2014). Tin, copper, nickel, gold, iron,bauxite, chromium and potash resources are widely distributed in the Southeast Asia, show considerable economic significance, have obvious complementarity to China, especially the laterite type bauxite, and is paid wide attention by Chinese geologists and mining industry in recent years. Although the exploration and development degree of laterite type bauxite in Southeast Asia is very low, studies show that the Southeast Asia will be one of the most important bauxite suppliers and resource bases in the world in the coming years (Yokart et al., 2003; Khin Zaw et al., 2014). With the discovery of several world-class mineral deposits, the reopening of a number of old mines and the improvement of exploration technical level, the metallogenic studies and mineral exploration have attracted increasing attention among the international mining communities. In carrying out the idea of “two types of mining markets and two kinds of mineral resources” in China, the Southeast Asia will be one of the best choices. Although the Southeast Asia is still frontier area for exploration and mining, the present activity of exploration is very promising. For the purpose of clear understanding of the crust evolution and regional metallogeny, this introductory paper provides a summary of the geological features, temporal–spatial distribution regularities and metallogenic characteristics of the laterite type bauxite deposits in Southeast Asia. Meanwhile, the regional geological and tectonic setting and laterite type bauxite ore-forming processes have also been discussed. The purpose of this study is to fill the knowledge gap of our understanding of the metallogenic characteristics of laterite type bauxite associated with the Late Cenozoic basalt in Southeast Asia. To better find new laterite type bauxite deposits in the Southeast Asia, we should conduct more detailed researches both on regional metallogeny and on individual mineral deposits.

2 Regional Geological and Tectonic Setting

The formation of mineral resources was associated with a long and complex tectonic evolution history of Gondwana Supercontinent break-up, arc magmatism, backarc basin development, together with arc-continent and contient-continent collisions in Southeast Asia (Khin Zaw et al., 2014).

Mainland Southeast Asia is located at the zone of convergence between the Asia, India-Australia, and Philippine sea-Pacific Plates (Metcalfe, 2011a,b, 2013). The present day Southeast Asia is the result of more than 400 millon years of continental rifted away from the northwestern Gondwana margin at different epochs in the Phanerozoic which led to the Palaeo-Tethys, Meso-Tethys and Neo-Tethys were opened and sequently destroyed, and continental fragments subduction, collision, convergence and accretion (Metcalfe, 2013;Searle et al., 2012; Sone et al., 2008). Mainland Southeast Asia consists of a complex continental fragments, volcanic arcs/backarc basins, and suture zones. The major continental fragments include Indochina, Sibumasu, West Myanmar terranes, Sukhothai terrane, Inthanon terrane and Sumatra which were derived from the southern Gondwana supercontinent.

During the whole history process of the Gondwana supercontinent break-up and the subsequent Mainland Southeast Asia amalgamation, most of the continental fragments that now make up Southeast Asia have occurred long-term various subduction-accretion, arc-continent collision, continent-continent collision and interactions, and resulted in the mutiple orogenic events, magmatism, tectonism, and metamorphism which have generated many mineralized fold belts at the most of the continental fragments margins. Throught the evolution process from Gondwana supercontinent break-up to the present-day Mainland Southeast Asia formed, long-term multiple tectonic-magmatic-metamorphic-hydrothermal interactions have occurred among these Mainland Southeast Asia continental fragments and created superior metallogenic gelogical conditons for a wide variety of mineral resources.The major types of deposits in Southeast Asia inciude porphyry type copper (gold-molydenum) deposits, orogenic type gold deposits, skarn type copper-gold deposits, epithermal type gold-silver deposits, laterite type bauxite deposits and other deposits types such as intrusion-related gold deposits, VHMS, MVT, SEDEX, IOCG, granitoid-related tungsten-tin deposits, REE deposits and potash deposits (Yokart et al., 2003).

There was an intense volcanic activity in the eastern margin of Indochina block in Late Cenozoic. During the Late Cenozoic volcanic activity, the largescale basalt belts were formed which are of close genetic connection with the laterite type bauxite deposits in this region.

* Corresponding author. E-mail: chen6100117@126.com

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3 Metallogenic Characteristics of Laterite Type Bauxite Deposits

3.1 Distribution of Late Cenozoic basalt belts and laterite type bauxite deposits in Indochina block

The Late Cenozoic basalt are widely distributed in Bolaven plateau in Laos, Mondulkiri plateau in Cambodia and western plateau in central Vietnam and the neighboring regions of those plateau in Indochina block. In space, the distributions of laterite type bauxite deposits were consistent to the distributions of Late Cenozoic basalt belts in Indochina block. Based on the analysis of the spatial distributions relationship between the laterite type bauxite deposits and Late Cenozoic basalt belts, this paper propose that, the laterite type bauxite deposits in Indochina block show an close genetic connection, and its matallogenic materials come from the Late Cenozoic basalt belts.

3.2 Orebody characteristics

The major laterite type bauxite deposits were located in the eastern margin of Indochina block and formed by basalt weathering. Basalt was widely distributed in Indochina block, ore-forming material sources are abundant. orebody occurs in laterite weathering crust of basalt. The planar shape of orebody is mainly controlled by geographic and geomorphic conditions. The orebody distributes in the platform of slope as planar and is restricted by the slope. The planar shape of orebody is irregular on the surface.

3.3 Exploration and development potential of laterite type bauxite

The Indochina block has good ore-forming geological conditions for laterite type bauxite, including the Late Cenozoic basalt was widely distributed in this region, ore-forming material sources are abundant and the tropical monsoon climate environment, and has good prospects for finding and exploration & development of laterite type bauxite resources.

Key words: Late Cenozoic, volcanic rock, laterite type bauxite deposits, Southeast Asia

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About the first author

CHEN Xifeng, male, born in 1979 in Shandong Province; doctor; senior engineer of Development and Research Center, China Geological Survey; He is now interested in mineral deposit.Email:chen6100117@126.com; phone: 13693308853.