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Compilation of West African mineral deposits: Spatial distribution and mineral endowment

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ABSTRACT

The West African Craton is highly endowed in minerals, and their spatial and temporal distribution varies from single to multi-phase mineralization events. They are broadly related to three major tectono-metallogenic elements and formed during distinct mineral epochs: (1) In both Archean Shields (Kénéma-Man and Reguibat) and Paleoproterozoic domains (Baoulé-Mossi, Eglab). These are characterized by giant iron ore deposits that formed between ca. 2.5–2.3 Ga, nearly all gold, porphyry copper, lead–zinc and sedimentary manganese ore that developed between 2.2 and 2.1 Ga, and primary diamonds that formed between two intervals at ca. 2.2–2.0 Ga and in the Mesozoic. (2) Across Pan-African and Variscan belts. These are distinguished by major Precambrian IOCG's, copper–gold that formed at ca. 2.1 Ga and approximately 680 Ma, and Neoproterozoic sedimentary iron ore and phosphate deposits. (3) Within intracratonic and coastal basins. These include the development of Cenozoic lateritic bauxites over Mesozoic dolerites, Tertiary/Quaternary mineral sands deposits, oolitic iron ore and sedimentary phosphate deposits. Geological, spatial and temporal correlations using the multi-commodity West African Mineral Deposit Database highlight that gold and non-gold commodities formed in multiple phases. This commenced in the Liberian Orogeny (2.9–2.8 Ga) with the enrichment of iron ore, nickel sulphides, diamonds and gold in the earth's crust. The pre-Eburnean or Tangaean–EoEburnean–Eburnean I Event yielded gold, and the major Eburnean Orogeny yielded gold, iron ore, manganese, diamonds, magmatic nickel sulphides, copper–gold, lead–zinc, and REE minerals. Throughout the Pan-African event sedimentary manganese deposits, lead–zinc, REE minerals, sedimentary phosphates, and again gold were formed. Primary diamonds and magmatic nickel sulphides are related to the break-up of Gondwana, followed by an intense lateritic weathering period that formed bauxite deposits along the craton margin.

1. Introduction

Over the last two decades West Africa has become a focus for mineral exploration and exploitation with world-class resources of gold, iron ore, diamonds, bauxite, phosphate, uranium and other commodities. The majority of these deposits are situated in the vast West African craton, and are hosted within basement rocks, along the margins of the craton, or are situated in intracratonic and coastal basins (Fig. 1). Exploration activities are mostly limited to gold in greenstone and volcano-sedimentary belts, iron ore related to Archean BIF (Banded Iron Formation), and IOCGs (Iron Oxide Copper Gold) and VMS (Volcanogenic Massive Sulphide) deposits.

The geology of the craton is generally composed of Archean to Paleoproterozoic crystalline and volcanoclastic basement rocks that are unconformably overlain by Paleoproterozoic volcano-sedimentary sequences and these in turn intruded by TTG granitoids and granites.

Over the last 30 years, the number of gold discoveries has exceeded all other commodity types by volume with economic gold deposits discovered, delineated and developed in Mali, Mauritania, Senegal, Burkina Faso, Ghana and Cote d'Ivoire.

The focus of this paper is to provide a geological overview of the West African Craton, including the tectonic evolution and mineral endowment of the craton based on the updated West African Mineral Deposit Database (WAMDD). This unique database was produced between 2010 and 2013 by compiling available geological and resource data for the West African Craton and included

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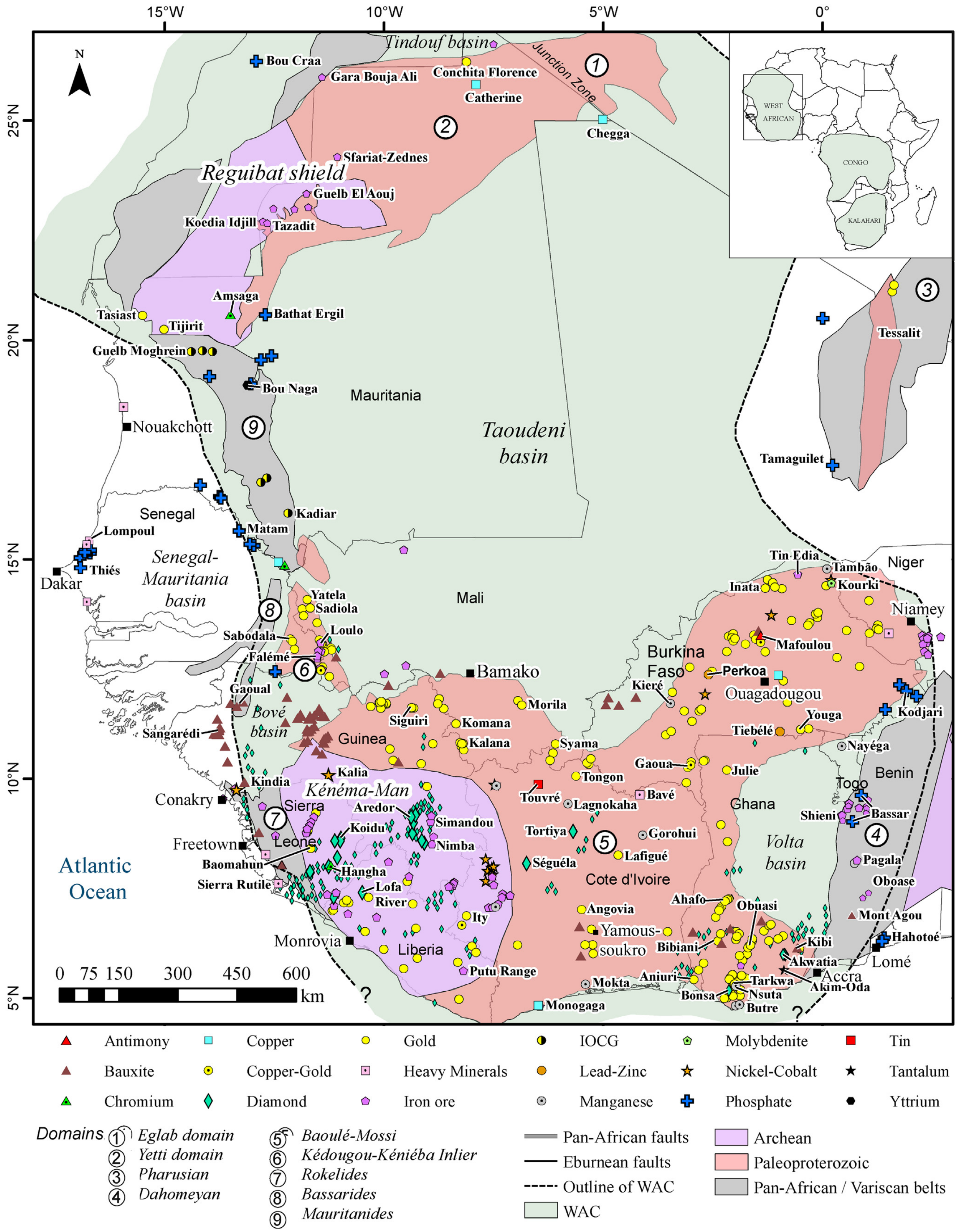

Fig. 1. A simplified map of the West African Craton that highlights the distribution of all known mineral deposits listed in the WAMDD. The limit of the craton is shown as a dashed line; map modified after Deynoux et al. (2006), Feybesse et al. (2006), Schofield et al. (2006), Gueye et al. (2007) and Villeneuve (2008).