China’s Manganese Geological Research and Prospecting have Achieved Great Breakthrough

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Data announced by the Chinese Ministry of Land and Resources in 2015 suggest that China has discovered more than 480 manganese ore-producing areas, with manganese ore resource reserves up to 1.22 billion tons, including 0.303 billion tons of basic reserves and 0.915 billion tons amount of resource. Among these reserves, manganese carbonate ores account for 56%, manganese oxide ores (including spongy manganese ores) accounts for 25%, and other types of manganese ore occupy 19%. Rich ores with >30% manganese content only account for 5% of the total resource amount, and the remaining 95% are poor manganese ores. Since 1983 when China first began to import, the imported manganese ores have increased annually by 25%. In 2001, the annual imported manganese ores reached 1.71 million tons. From 2010, the annual imported manganese ores increased by greater than 45%, reaching up to 12 million tons in 2015. Thus it seemed that the shortage of manganese ore resources will be a long-term phenomenon for China’s economic development.

Since 2012 when China implemented the 12th Five Year Plan, manganese ore prospecting efforts have strengthened, and China has newly discovered a large number of deposits and mineralized spots in Guizhou, Guangxi and Sichuan provinces on the western margin of the Yangtze Plate and Xinjiang on the western margin of the Tarim Plate. Thus China’s manganese ore prospecting has made an important breakthrough.

In Guizhou Province, two world-class super-large manganese deposits of Daotuo and Xixibao deposits in Songtao County have been recently discovered, with manganese ore resources amounting to 0.4 billion tons. These deposits occur in Cambrian black shales, and are composed of rhodochrosite ores, manganese-bearing dolomite, shale and sandstone, which together are called Dapotang-type manganese deposits.

In the Xialei ore district of Daxin County in Guangxi, marine sedimentary manganese deposits and secondary manganese oxide deposits have been discovered in Upper Devonian strata, with manganese resources and reserves up to 0.242 billion tons. Among these, the Xialei manganese deposit contains 9.52 million tons of manganese oxide ores at an average Mn grade of 32.81% and 0.122 billion tons of manganese carbonate at an average Mn grade of 22.07%. In the peripheral and deep parts of the Xialei ore district, five prospecting targets were also delineated, with newly discovered 351.78 million tons of resources and reserves at an average Mn grade of 19.14%, ranking as large-scale manganese deposits (Fig. 1). In the peripheral and deep positions of the Dongping manganese ore district of Tiandeng County in Guanxi, a new orebody extending 6 km in the horizontal direction and 600–1300 m in the vertical direction was discovered, with a healthy 0.14 billion tons of Mn resources. The Lower Triassic Beisi Formation in the Fuwan ore block of Guanxi has newly discovered 86.72 million tons of Mn resources and reserves; this area has realized a total of 0.22 billion tons of resources and reserves.

In the surrounding areas of the Changqiang dome in the Muli area of Sichuan, the Permian Kawenggou manganese-bearing strata were also discovered. A total of one medium-sized manganese deposit, two small manganese deposits and five ore spots were found. Three manganese-bearing ore belts were discovered, and the orebodies are 469–720 m long, 9.07 m thick at an average Mn grade of 25.41%, with shallow oxidized ores and deep primary rhodochrosite ores. In the Moxian faulted basin of the northern segment of the Longmenshan Fault Zone, 38.70 million tons of the Cambrian sedimentary manganese carbonate resources at an average manganese carbonate grade of 15% were discovered.

In the western Kunlun area west of the Tarim Plate, three manganese prospecting areas-Wuqia–Aheqi, Zhaosu and Motuosala–Kumishen, were discovered. Among them, the Aoertuokanashen rich manganese deposit has a manganese ore seam of 5.5 km long, 0.6–22.32 m thick, 4.14 m thick on average, extending 130–200 m to the deep, with an average Mn grade of 35.15%, reaching up to 55%. The Maerkantu rich manganese deposit has a manganese ore seam of 3 km long, with an accumulated thickness of 7 m,
at an average Mn grade of 20%–50%. The ores are dominated by manganese oxides and manganese carbonates. The manganese oxide ores contain main minerals of pyrolusite and psilomelane, with an average Mn grade of 20%–50%. The manganese carbonate ores are dominated by calcimangite, with minor amounts of dolomite and rhodochrosite, and Mn grade of 13%–20%.

During the manganese ore prospecting, China’s geologists have proposed a new understanding of the Datangpo-type manganese mineralization accompanied by ancient natural gas leakage. It is considered that the South China Plate first formed a rift basin under the geological setting of the Rodinia supercontinent break-up in the Mesoproterozoic. Mantle-derived fluids from the Earth’s interior and manganese migrated upward to the surface rift (graben) basin, and ancient natural gas (organic matter) leakage and eruption and manganese precipitation occurred in the basin center. Synsedimentary faults act as an important upward conduit of the deep manganese and natural gas, and also connect the mantle and the surface (Fig. 2). This new model of manganese ore prospecting has laid a foundation for prospecting a number of world-class super-large manganese ore deposits in the rift sedimentary areas of southeastern Guizhou Province.

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