Until the beginning of the 20th Century, nonsulfide Zn ore was the principal source of zinc in the world. These oxidized Zn ores, also called Zn “oxides” or “calamines”, comprise mainly Zn carbonates (mostly smithsonite and hydrozincite), Zn silicates (hemimorphite, more rarely willemite or Zn-rich clays), and even more rarely true Zn oxides (zincite, franklinite). The development of floatation and smelting technologies in the late 19th Century allowed the exploitation of sulfide ores and led to a shift from nonsulfide to sulfide Zn sources. In 1996, less than 5% of the total world Zn production came from nonsulfide ores.

This situation is going to change rapidly in the near future. Recent achievements in hydrometallurgical technologies have revived the interest in nonsulfide Zn deposits, mainly due to the possibility of low-cost, on-site Zn production (Large, 2001; Hitzman et al., 2003), paired to a lower degree of environmental pollution. In September 2003, the Skorpion nonsulfide Zn mine in southern Namibia started its production with the first commercial application of Zn acid-leaching, solvent-extraction and electro-winning. A steadily increasing number of nonsulfide Zn prospects are currently evaluated among which the Mehdi-Abad deposit, Iran-Kuh and Kuh-e-Surmeh.

Reichert and Borg describe a new two-stage geochemical model of supergene carbonate-hosted Pb–Zn mineralization based on their observations in Iranian deposits of Mehdi-Abad, Iran-Kuh and Kuh-e-Surmeh. They also discuss the importance of an arid climate in the formation and preservation of nonsulfide ore. Gilg et al. review the stable isotope geochemistry of supergene Zn–Pb carbonates. They derive also new oxygen isotope mineral–water fractionation equations for smithsonite, cerussite and phosgenite. Their new oxygen isotope geothermometry resulting from a variety of carbonate- and silicate-hosted deposits including the giant Broken Hill deposit, New South Wales, Australia, has revealed temperatures of supergene Zn–Pb carbonate formation below 30 °C that contrast with earlier suggestions (Melchiorre et al., 2001). Schneider et al. explore the Rb–Sr method to directly date hydrothermal willemite formation in the Otavi Mountainland, Namibia. Their preliminary results from Berg Aukas and Abenab West deposit suggest hypogene Zn silicate formation from precursor sulfides between 490 and 560 Ma.

The last two papers are focused on two historical nonsulfide districts in Europe. The first mineralogical characterization of the nonsulfide Zn–Pb ores at Silvermines and Galmoy, Ireland, is presented by Balassone et al. The authors are able to trace systematic changes of chemical composition and morphological characteristics of smithsonite within the paragenetic sequence of the immature supergene ore. Coppola et al. have studied the nonsulfide ores (“calamine”) of Eastern Belgium. Their study shows that the genesis of the willemite orebody at Kelmis (also known as La Calamine or Altenberg) is clearly distinct from other hydrothermal willemite deposits, such as Vazante, Brazil, Beltana-Aroona, Australia, or Star Zinc, Zambia (Hitzman et al., 2003). The willemite formed by very low salinity and probably very low temperature (<80 °C) fluids at the expense of earlier deposited sulfides and was subsequently transformed by supergene processes to a smithsonite–hemimorphite dominated assemblage. This
special issue highlights the complexity of nonsulfide Zn–Pb ore formation both in weathering and hydrothermal environments, but also presents new approaches to understand the origin of this new (old) class of ore deposits.

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