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The Mesozoic-Cenozoic igneous intrusions and related sediment-dominated hydrothermal activities in the South Yellow Sea Basin, the Western Pacific continental margin

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ABSTRACT: Various igneous complexes were identified in multi-channel seismic reflection profiles from the South Yellow Sea Basin. It is not rare that magmatic intrusions in sedimentary basins cause strong thermal perturbations and hydrothermal activities. Some intrusion-related hydrothermal vent complexes have been identified and they are considered to originate from the deep sedimentary contact aureole around igneous intrusions and terminate in upper vents structures, and are linked by a vertical conduit system. The upper vent complexes are usually eye-shaped, dome-shaped, fault-related, crater-shaped or pock-shaped in seismic profiles. A schematic model was proposed to illustrate the structures of different types of hydrothermal vent complexes. A conceptual conduit model composed of an upper pipe-like part and a lower branching part was also derived. Hydrothermal vent complexes mainly developed during the Middle-Late Cretaceous, which is coeval with, or shortly after the intrusion. The back-arc basin evolution of the area which is related to the subduction of the Paleo-Pacific plate during the Mesozoic-Cenozoic may be the principal factor for voluminous igneous complexes and vent complexes in this area. It is significant to study the characteristics of igneous complexes and related hydrothermal vent complexes, which will have implications for the future study of this area.

Keywords: Igneous intrusions; Hydrothermal vent complexes; South Yellow Sea Basin; Western Pacific continental margin

1. Introduction

Magmatic intrusions in sedimentary basins usually provide enough heat to develop hydrothermal activity (Delaney, 1982; Einsele et al., 1980; Hansen, 2006; Jamtveit et al., 2004; Planke et al., 2005; Svensen et al., 2006). The South Yellow Sea Basin is a large-scale back-arc sedimentary basin located in the area of the widespread East Asian continental igneous rocks belt (Fig.1a), which is attributed to the subduction of the Izanagi Plate (i.e. Paleo-Pacific Plate) during the Mesozoic-Cenozoic (Kinoshita, 1995; Okada, 2000; Windley et al., 2010; Wu et al., 2005). Multi-channel seismic data and magnetic anomaly data both reveal the prevalent emplacement of igneous complexes in the South Yellow Sea Basin and its adjacent area (Cukur et al., 2010; Lee et al., 2006). Abundant intrusive and extrusive igneous complexes, such as sills, dikes, stocks, and volcanic edifice relics, could be identified easily in seismic reflection sections from the South Yellow Sea Basin. Seismic data can provide constraints on the coupling relationship between intrusions and hydrothermal vent complexes (Planke et al., 2005). Some crater-chimney like structures are geometrically similar to those hydrothermal vent complexes previously described in the basins offshore mid-Norway (Planke et al., 2005; Svensen et al., 2003) and the basins in South Africa(Jamtveit et al., 2004). Associated hydrothermal activities were considered to be triggered and driven by magmatic sills intruding into porous and permeable sedimentary strata (Einsele et al., 1980).

As a large-scale superposed sedimentary basin composed of pre-Indosinian marine craton deposition and Mesozoic-Cenozoic continental rifted-basin deposition, the South Yellow Sea Basin has a favorable potential of oil and gas exploration (Zhang, 2008; Zhang et al., 2014). The igneous activity