

Mud diapirs and associated intrusion structures in the Miocene Tanabe Group, Kii Peninsula

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The material and intrusive structures of several mud diapirs in the Miocene Tanabe Group, southwest of the Kii peninsula were examined to reveal the fluid intrusion style and processes. To examine factors controlling the intrusive styles, tank experiments was also performed.

Three types of intrusive structures such as cylinder, dome, and sill types were observed in ascending order in the Shirahama Formation overlying the muddy Asso Formation of the Tanabe Group. (1) Cylinder type: The Ichieminami mud diapir, the about 20m in diameter, intruded into bedded sand and siltstones almost vertically. The majority matrix is composed of siltstone, with subordinate sandy part and quartzose sandstone in inner part. (2) Dome type: Ichiezaki mud diapir has a dome shape of about 150m in diameter including blocks and sand grains of host sediments by stoping. The dykes radially intruding into hostrocks are clayey in the early stage and sandy in the later stage. (3) Sill type: The mud diapir of the Migusa represents the lens shaped lacolith with at least 200m in length, mainly consists of pebbly mudstone involving blocks of surrounding strata. There is a lot of small-scale mudstone sills and dykes above the diapiric body. As a result of tank experiments, it was observed that a series of lenticular intrusive slurry body with dome like upheaval above, transforming into the mud chamber expanded with stoped blocks and particles of host sediments. When it collapsed, a conduit of upward escaping muddy fluids, sill and dyke structures are formed above the mud chamber.

Based on the correlation between the diapiric structures in the Tanabe Group and intrusive features in the tank, (1) Cylinder type intrusion of the Ichieminami diapir is indicative of rising path of the muddy water to the mud chamber formed in the water tank. Such a vertical path shows a concentrated fluid flow cut through permeable sedimentary strata without any muddy impermeable intercalation. (2) Dome type Ichiezaki diapir corresponds to a water-filled cavity in the upper part of expanding mud chamber or the upper most part of a cylinder type intrusive body formed in the water tank where the stoping process is most active. (3) Sill type Migusa intrusive body is thought to represent the early stage of the mud chamber formation intruded into layered sediments with remarkable permeability contrast.

Consequently, mud diapirs of the Tanabe Group show a variety of intrusive structures due to a single event that a high-pressured fluid with small amount of mud injected through a narrow conduit to the level where a large mud chamber expands one after another, by which different types of intrusive structures are formed in accordance with permeability contrast and the degree of solidification of the host sediments.