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Overview of the Wayang Windu geothermal field, West Java, Indonesia

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Abstract

The Wayang Windu geothermal field, West Java, Indonesia, is interpreted to be transitional between vapour-dominated and liquid-dominated conditions with four coalesced fluid upwelling centres that generally become younger and more liquid-dominated towards the south. Two of these centres are associated with the large Gunung Malabar andesite stratovolcano and the other two with the smaller aligned Gunung Wayang and Gunung Windu andesitic volcanoes to the south. The overall potential resource area is of the order of 40 km^2. Deep wells encounter a deep liquid reservoir whose top, which ranges from 0 to 400 m above sea level (m asl) becomes progressively deeper toward the south. As pressure versus elevation conditions are the same throughout the deep liquid reservoir it is likely to be contiguous. This liquid-dominated reservoir is overlain by three separate vapour-dominated reservoirs. The northernmost is the largest as it is coalesced over two separate fluid upwelling centres. Its low gas content, size, prolonged productivity and isobaric for elevation nature, preclude it from being a parasitic steam zone. Mineralogical relationships demonstrate that this vapour zone was originally liquid-dominated with a deep water level as high as 1700 m asl. Subsequent boil off may reflect low recharge rates due to hydrological isolation at depth. To the south, the vapour-dominated reservoirs decrease in thickness and are characterized by progressively higher pressures, temperatures and gas contents. These changes suggest that the southernmost vapour-dominated zone is the youngest and that these zones become increasing older to the north.

Keywords: Vapour dominated; Liquid dominated; Wayang Windu geothermal field; Java; Indonesia

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1. Introduction—regional geothermal setting

The Wayang Windu geothermal field is located approximately 35 km south of Bandung, the provincial capital of West Java, Indonesia (Fig. 1). It is one of a cluster of geothermal fields around Bandung that also includes Darajat (Hadi et al., 2005), Kamojang (Utami, 2000), Karaha-Telaga Bodas (Moore et al., 2002, 2004), Papandayan (Wibowo, 2006), Patuha (Layman and Soemarinda, 2003), Tampomas (Wibowo, 2006) and Tangkuban Perahu (Wibowo, 2006).

These fields lie within andesitic, volcanic highlands formed by a concentration of volcanic centres in this part of the Sunda Arc. The city of Bandung is located in a basin (Dam, 1994) near the centre of the highlands. That basin does not appear to be a back-arc basin, as it has arc volcanics on either side, but may owe its origin to flexure from varying rates of subduction roll back along the Sunda Arc. This arc has formed in response to the subduction of the Australian–Indian Plate beneath the Eurasian Plate. It has been active since the Cretaceous (Whittaker et al., 2007), but has undergone changes as increasing amounts of Australian continental crust have become involved in the collision and it is undergoing roll back. The dominant strike directions of the major faults in West Java are 40° and 340° (Wibowo, 2006; Fig. 1), forming a conjugate pair of strike-slip faults, consistent with compression due to near-perpendicular subduction.

2. Geothermal exploration

Initial exploration of Wayang Windu was undertaken by Pertamina (Sudarman et al., 1986). It included sampling and analysis of thermal springs, DC resistivity (Schlumberger array) traversing,

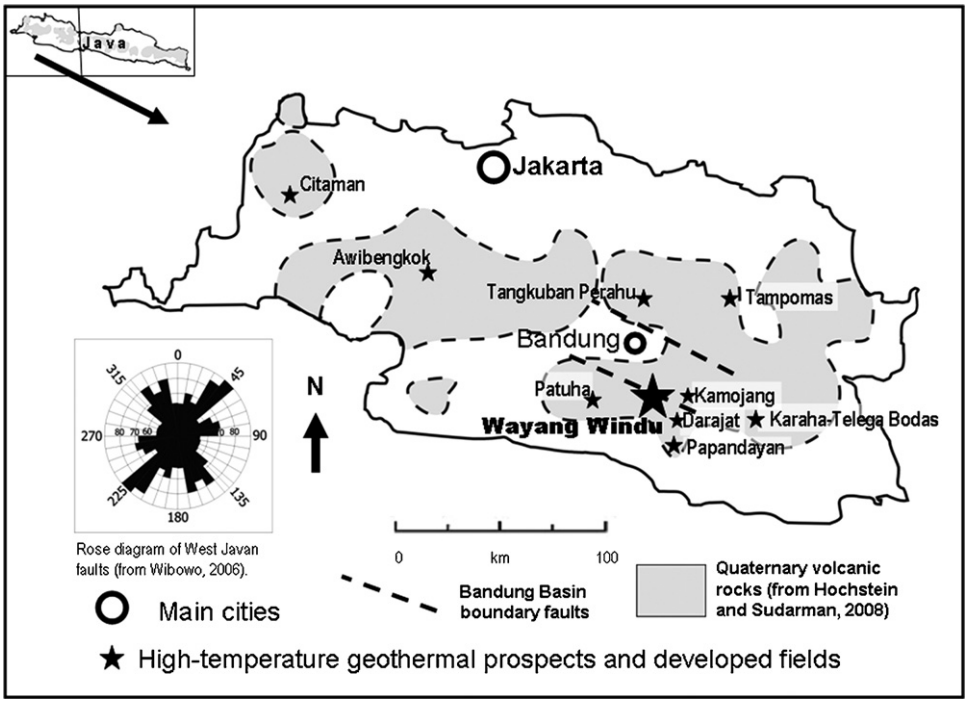

Fig. 1. The distribution of Quaternary volcanic rocks and high-temperature geothermal fields in West Java, Indonesia.