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Eruptive history of Arenal Volcano, Costa Rica, 7 ka to present

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Abstract

New tephra-stratigraphic studies of Arenal volcano have been used to update its volcanic history. Deposits of major eruptions are renamed AR-1 to AR-22 (from older to younger, in stratigraphic order), extending from 7 ka B.P. to 1968 A.D. Arenal tephra overlie regional tuffs that are >20,000 years old. Isopachs and characteristics of the most relevant and recognized fall deposits are presented. Among Arenal eruptions, plinian events like AR-20, AR-15, AR-12 and AR-9, were the most relevant, with tephra volumes up to 0.44 km³. These plinian eruptions are separated by periods of 750–1080 years. Also 8 subplinian, 7 violent strombolian and 2 vulcanian eruptions have been recognized and correlated in Arenal's tephra sequence. Tens of other minor explosive eruptions resembling in size to AR-22, which occurred in July 1968, have been recognized. Lava cycles have generally followed the plinian eruptions. Typical erupting volumes for these cycles have been in the order of ~ 0.7 km³. The estimated total volume of tephra fall is ~ 4.5 km³. The rate of total volcanics erupted is ~ 2.7 km³ ka⁻¹ (0.086 m³ s⁻¹). The tephra sequence previous to AR-9 (3200 B.P.–7000 B.P.) has no dark soils, whereas the overlying sequence does. It is presumed to be a consequence of regional climatic changes from a dry environment to a rainy tropical one.

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1. Introduction

The volcanic arc of Costa Rica is divided in three sections – Guanacaste, Tilarán and Central Ranges – with Arenal volcano at the northwestern end of Tilarán Range (Fig. 1). The whole volcanic front runs from northwest to southeast, 150 km landward of the Mid American Trench. The crust under Arenal has a thickness around 40 km (43.5±7 km according to Matumoto et al., 1977; 38–40 km according to Sallares et al., 1999; and ~ 40 km

according to Yao et al., 1999), and its lower part includes granulites and metagabbros (Sachs and Alvarado, 1996). The youngest eruptive centers of the Tilarán Range are Los Perdidos Complex (ca. 90 ka), Chato volcano (38 ka to 3.8 ka; Gillot et al., 1994), and Arenal, whose eruptive history is detailed in this paper.

References to Arenal as a volcano date back to the 19th century. It has been called by several different names: *Los Ahogados*, *volcán de Costa Rica*, *Río Frío*, *volcán de los Canastos* or *Pelón*, *Pan de Azúcar* and *cerro de los Guatusos*. The area where it is located remained poorly explored until 1937, when a documented mission explored the summit (Alvarado, 2000). Nevertheless, Arenal continued to be nearly ignored by local geographic texts until its disastrous eruption in July 1968.

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