

Yoron Island in Southern Japan - Quaternary Geology and Solution Controls on Surface Landforms

James P. TERRY

*The University of the South Pacific
PO Box 1168 Suva
Fiji Islands*

Abstract

Yoron Island is a small carbonate island in the Ryukyu Island Arc of southern Japan, lying 27 km north west of Okinawa. The island emerged above sea level in the Quaternary period as a result of uplift associated with plate boundary tectonics. Yoron's geomorphology is characterised by a variety of features which are typical of emerged carbonate islands, such as angular limestone cliffs, cusped bays with beaches of coralline sediments, marine terraces at different elevations, fault escarpments, ridges, vadose cave systems, and numerous shallow dolines (closed surface depressions). The spatial patterns and inter-relationships between these landforms are determined by a number of factors. These include structural controls associated with island uplift, variations across the island in the surface exposure of different carbonate geologies (e.g. reef and rhodolith limestones and Holocene deposits), and solution processes which are influenced both by 1. allogenic recharge along faults or carbonate/non-carbonate geological boundaries and 2. groundwater lens interaction with sea level in coastal localities.

Key words: geomorphology, solution features, Quaternary limestones, Yoron Island

Introduction and Background

Yoron Island, also known as Yoronjima and Yoron-to, is located in the centre of the Nansei-Shoto group of islands of southern Japan, approximately 40 km NW of Okinawa island, at latitude 27°01'N, longitude 128°24'E (Fig. 1 and 2). The shape of the island resembles an angel fish, with a narrow peninsula at the western end. The land area covers just 21 km² and the coastline is 23 km in circumference. Approximately 6000 people live permanently on Yoron, but a large number of tourists visit each year, especially in summer. The climate is subtropical with a mean annual temperature of 23°C. Annual rainfall amounts to 2200 mm, some of which occurs as torrential downpours associated with typhoons in summer and early autumn (July to September). The original native forest has been cleared for agriculture, namely sugar cane farming and beef cattle grazing. There are no permanent surface watercourses on Yoron because the geology mostly comprises permeable carbonates. However, a large freshwater aquifer 30-40 m thick, exists within the bedrock, the hydrological balance for which was estimated as evapotranspiration 45%, runoff 15%, groundwater recharge 40% by MOMII *et al.* (2001).

Yoron is part of a chain of islands, formed as a volcanic island arc and known as

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E-mail: terry_j@usp.ac.fj

