

Palaeogeographic reconstruction of the 1.55 Ma synchronous isolation of the Ryukyu Islands, Japan, and Taiwan and inflow

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Below is abstract shown in Osozawa et al., 2011, International Geology Review. The Ryukyu islands evolved from a continental margin arc to their present configuration as an island arc, accompanied by subsidence and isolation of islands, by back-arc spreading of the Okinawa trough that continued to the present. The time of island isolation is recorded by trough-parallel half grabens filled by marine siltstone, as well as such sediments filling orthogonal fault-controlled and other non-fault-controlled valleys surrounding each island. New Quaternary nannofossil biostratigraphic data shows deposition marine siltstone noted above at 1.55 Ma. At that time, the entire 1000-km-long island chain comprising the Ryukyu islands separated from Asian continent by rifting extending from the Okinawa trough to the Tsushima strait. The Tokara, Kerama, and Yonaguni gaps, branched or transverse rifts of the Okinawa trough, separate the island chain into subgroups of the Osumi, Amami, Okinawa, and Yaeyama islands, and Taiwan. The shallow Taiwan strait separated Taiwan from the Chinese mainland. The Kuroshio warm current that previously ran off shore of the continental margin arc, began to flow into the opening backarc basin through the Yonaguni gap and flow out the Tokara gap, flowing along the axis of the Okinawa trough. Under influence of the warm current and because of entrapment of the Yellow and Yangtze rivers detrital sediments by the Okinawa trough, coral reefs formed around each isolated island. These reefs make up a unit called the Ryukyu limestone. Subsidence continued through the deposition of this limestone, resulting in further isolation of each island. Some islands did not separate from the mainland but emerged later from the sea as a result of volcanic edifice construction or forearc uplift. Following initial isolation the Japanese islands and Taiwan may have been connected to the mainland by land bridges during some sea level lowstands related to glacial periods, whereas the other islands remained isolated. Based on ages of isolation of each island, a Quaternary paleo-geographic map and phylogenetic tree of the islands can be drawn showing the separation time of the each island from the mainland and each other. This information should be useful for phylogenetic molecular biologists studying evolution of the Ryukyu endemic species and vicariant speciation, and facilitate analysis of DNA substitution rate.

Keywords: Ryukyu island arc, Okinawa Trough, island-encircling 1.55 Ma marine sediments, .55 Ma island separation, Kuroshio current, coral sea