

Climate and social changes in ancient Japan construed by use of high resolution reconstruction of the Climate in Historical Time

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This study focuses on ancient times of Japan, specifically the 8th and 9th Century in an attempt to clarify how the weather impacted societies then. Takeshi Nakatsuka developed per-annum reconstruction of climate for that period of time, which revealed that the 8th Century was, in general, relatively dry but stable, whereas the second half of the 9th Century turned to be unstable and wet, then in the 10th Century the weather changed to dry. Historical literature including Shoku Nihongi (second of the six classical Japanese history texts), Nihon Kouki (third of the six classical Japanese history texts), Shoku Nihon Kouki (fourth of the six classical Japanese history texts), Nihon Montoku Tenno Jitsuroku (fifth of the six classical Japanese history texts), and Nihon Sandai Jitsuroku (sixth of the six classical Japanese history texts) described history of said period and included the description of the weather then. However, they are very brief and do not provide precise details as to the severity of drought, spells of rain or torrential rain. At long last, high-resolution weather reconstruction helps to bring clarity to the level of extreme dryness and humidity of summer and the damage they brought about, when we review historical documents. Additionally, the deeper understanding of the mid- to long-term weather pattern changes helps to visualize the interrelationship between the climate change and changes in the state and societies.

In this research, our interest, in particular, lies on demographic change and social system transformation in ancient times. In the early 8th Century Taiho Code was enacted and a centralized government established a political system based on the Ritsuryo Codes, which demonstrated their intent to emulate the system in China. The systems set forth by the Ritsuryo-Code-based-nation laid the foundation for the framework of Japan and played an essential role in defining the subsequent development of its history. The population that the state of the Ritsuryo Codes ruled is estimated to be around 4.5 million at the beginning of the 8th Century and approximately 5.5 million at the beginning of the 9th Century, with the average population growth rate from the 8th to 9th Century being 0.2% per annum. The population in the 17th Century, the beginning of the Edo era, is estimated as 12-18 million. The population slightly increased from the ancient times to early modern times. The yearly population increase over a course of 800 years from the mediaeval to early modern times was only 0.1-0.15% at best. Ancient Japan was frequently visited with plague and famine, which kept the nation highly fluid and vulnerable. Despite this situation, yet the population growth was at a higher rate comparing to the middle ages. This is considered due in part to a high functioning reproductive system set forth by the Ritsuryo system in which the central government exercised control over the people's lives and rice paddies and also by a relatively stable weather in the 8th Century.

Changes in Tang dynasty and Shilla, the neighboring countries of Japan, affected the Ritsuryo system in Japan, which collapsed little by little. The Ritsuryo-based-nation considerably changed from the late 9th Century to late 10th Century. These social changes were triggered by the changes in the overseas political landscape in its vicinity as well as the climate change. In the second half of the 9th Century they faced problems of the rise of non-arable rice paddies and flooding of rice fields. We are convinced that the climate change resulting in the humidity level increase of the land was at the root of these problems at that time. The Ritsuryo system started to give up on its exercise of control over its people and rice fields, thereby the reproductive system of the Ritsuryo state broke down. It was exacerbated by frequent

earthquakes, a volcano eruption, famine and pandemic, all of which occurred during the same time frame. It was a time of crisis for ancient Japan as a whole. The nation under the Ritsuryo codes established a centralized government at the beginning of the 8th Century, but in the late 9th Century and onwards it started to collapse and the central government was contracted into a dynastic state in the capital of Heiankyo.

Keywords: tree-ring oxygen isotope ratio, Ritsuryo system, population, Climate change