

Simulating the formation of erosion topography using Excel VBA: Sea Candles in Taiwan, and Dochu and Oninosentakuiwa in Japan

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1. Introduction

Spreadsheet software, especially the most popular Microsoft Excel, has been widely used for data processing on personal computers. VBA (Visual Basic for Applications), an integrated development environment for programming, is provided with Excel to make automated and advanced data processing possible. However, programming with VBA being fairly object-oriented is not so easy for its beginners. Hence, Shigeno (2008, 2009) reported various case studies on earth-sciences data processing using Excel VBA. Here, case studies on simulating erosion topography using VBA (Shigeno and Suto, 2009) are outlined.

2. Simulating formation of Sea Candles in Taiwan

Various kinds of strange rock objects have been developed by erosion of the Neogene sandstones in Yeliou Geopark located at the north coast of Taiwan (Suto, 2008a, b). These have been produced probably by the difference of the strength to erosion between various kinds of concretions (harder) and surrounding mother rocks (softer). Sea Candles have probably been formed specifically from a kind of three-layered spherical concretion, with the hardest core, softer mantle, and hard crust (by comparison to the earth), mainly by vertical erosion. The remained harder core and crust probably form the fire, and the shoulder of candle, respectively.

A VBA program has been produced for simulating the formation process of Sea Candles in a cross-section using color painting of cells on an Excel sheet. The algorithm is a kind of cellular-automata using Monte Carlo method. The program consists of four modules: (1) main, (2) setting initial rock distributions, (3) drawing initial rock distributions, and (4) calculating and drawing temporal changes. The figure of Sea Candles has been simulated fairly well by adjusting the parameter values and initial conditions of the above (1) and (2).

3. Simulating formation of Dochu in Shikoku and Oninosentakuiwa in Kyushu

Dochu, pillars produced from Quaternary fan deposits, and Oninosentakuiwa, shore platforms produced from slightly-tilted Neogene alternations of sandstones and mudstones, are special erosion topography ranked to Natural Monuments of Japan. Formations of these have been simulated by partly modifying the above VBA program. Fairly good results have been obtained by adjusting the parameter values and initial conditions of the above (1) and (2), and modifying the erosion process in (4), including the water depth effect for Oninosentakuiwa.

4. Conclusions

Very popular Excel has been applied very widely, including the earth-sciences fields. Excel 2007, the latest version, can manipulate fairly large-size data (ca. 16,000 x 1,000,000). Various kinds of difficulties of processing complex earth-sciences data could be solved partly by Excel VBA programming (hopefully in an open source manner). Also, various kinds of simulation and others using VBA, like this study, will be very helpful in educating earth-sciences. Copies of the Excel files produced by the above studies will be available to download from the above WWW homepage.

References

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