

# Integrated database and operation-presentation of rock alteration data from geothermal wells

# Hiroshi Shigeno[1]

[1] G.S.J., A.I.S.T.

Various kinds of rock alterations are produced by fluid-rock interactions through diagenetic, igneous and hydrothermal processes among others. They cause changes of rock properties (strength, permeability, thermal conductivity, etc.), and, in reverse, the changes bring feedback effects to the processes. In geothermal areas, various kinds of alteration zones, which are composed of various minerals formed in diverse temperature and chemical environments, are distributed indicating the complex space-time distributions of the heat sources and fluids, and the produced various results (developments of impermeable zones, land-slide areas, etc.)

Constructing open database for alteration data, especially for precious data obtained by well drilling, with temperature and geology data, are very important to enhance better understanding underground thermal structures and processes of nation-wide and local levels. The present author has been conducting 'Studies on Japanese geothermal resources assessment using GIS' (Shigeno and Sakaguchi, 2002). Hence, he has conducted a case study on integrated database construction and data presentation method development for alterations of well rock samples (Shigeno, 2004). In this study, a unified data format system with a constant depth interval ('one-dimensional mesh' format common to various kinds of well data) was tested for the purpose of easier integrated utilization of multicomponent, complex and voluminous well data, as follows:

(1) A simplified database, composed of a well information file (well name, longitude-latitude, depth, etc.), and a well logging and analysis data file (alteration with temperature and geology), was constructed on the basis of a spreadsheet software (Microsoft Excel). Systematic coding of alteration minerals and geologic units was tried. (2) A program group (GPWM) was produced for displaying various figures using the above database, on the basis of a programming environment for easy development and utilization (Microsoft Visual Basic). (3) Integrated presentations of the above figures and various kinds of 'GIS' data were made possible by using simple GIS and graphics software.

In this case study, exploration well data obtained at the Hoho geothermal area, Kyushu (NEDO and EPDC, 1987), were used. A database was constructed for alteration (11 minerals), logging temperature and described geology with 50-m depth intervals, using the data from 22 wells (500-3200 m depth). The alteration minerals were grouped into three by their assemblages corresponding to T-pH environments of their formations. Using the above database and methods, various figures were produced to show (1) the relations between the alterations shown in columns, and distributions of topography, geothermal areas and temperatures, (2) the distributions of the alteration groups, temperatures and geology plotted for specific depths and elevations, and (3) the comparisons of the alterations, temperatures and geology in compressed column forms adjusted to the elevation.

Many wells have been drilled for exploration and exploitation of geothermal resources in Japan, and rock alterations have been studied in the processes, but various preparation and analysis methods for rock samples, and various description systems of the results have been used. Hence, constructing an open integrated database using the unified data format system is under planning for wide and easy utilizations of the data. By applying the above common data format (hierarchical depth structure would be possible) to the well data, integrated operation, visualization, and numerical simulation will be easily and progressively conducted for various fields and objectives, using the well data and various surface 2-D and underground 3-D 'GIS' data (especially by overlaying data sheets, corresponding to the depths, of the standardized area mesh systems).