

# Chemical and isotopic characteristics of Fluids from the Holes of Taiwan Chelungpu-fault Drilling Project (TCDP)

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## Abstract

This study analyzed chemical composition and isotopic ratio of fluids from the Hole-A and Hole-B of Taiwan Chelungpu-fault Drilling Project (TCDP) to trace the source and find the possible causes of chemical variations along the depth. We collected 43 samples in Hole-A, 14 in Hole-B in 2006, each sample was separated into 4 sub-samples by adding 0、0.1、0.5、1.0 ml HNO<sub>3</sub> to evaluate the difference of chemical composition. For chemical composition, we measured cations such as Na<sup>+</sup>、K<sup>+</sup>、Ca<sup>2+</sup>、Mg<sup>2+</sup>、Al<sup>3+</sup>、Fe<sup>3+</sup>、Mn<sup>2+</sup>、Si<sup>4+</sup>; and anions such as F<sup>-</sup>、Cl<sup>-</sup>、Br<sup>-</sup>、NO<sub>3</sub><sup>-</sup>、PO<sub>4</sub><sup>3-</sup>、SO<sub>4</sub><sup>2-</sup>、HCO<sub>3</sub><sup>-</sup>. We also used filtered fluids without adding HNO<sub>3</sub> for isotope analysis.

The results show that an abnormal change occurred between the depth of 600- 700 m on the concentrations of Na<sup>+</sup>、K<sup>+</sup>、Ca<sup>2+</sup> and Mg<sup>2+</sup>. Besides, all ions show a slightly increase concentration at the depth of 1110 m. According to those variations with depth, we divided the fluids of Hole-A into four sections, named A, B, C, and D, respectively in the range of 0- 650 m, 650- 1080 m, 1080- 1140m, and 1140- 1290 m. The Na<sup>+</sup>、K<sup>+</sup> and Ca<sup>2+</sup> concentrations of fluid above or below 650 m depth (that is, section A and section B) is distinctly different so that the different sources of water could be suggested. The concentrations show slightly increasing on section C, including the main fault zone, where the casing was perforated, infer that fluid can actually flow into the well pipe via the punched holes to cause the chemical anomaly. Compositions between section B and D are different, especially on the Mg<sup>2+</sup> ion. We, thus, separate them into two sections for further discussions and study. Based on casing and our data, the chemical difference between sections might caused by leakage from the location of casing shoes; where depth of 661 m and 1301 m could be

the source of fluids. It is highly possible that the water leaked from 661 m depth to cause the obvious anomaly of 600- 700 m. Also, the high ionic concentration within the section D could be respond to the leakage from below 1301 m in depth.

Comparing to the compositions of Hole-A and Hole-B, it is clear that the fluid source of hole-A and hole-B core is different.