# $^3$He/$^4$He ratios of fluid samples in Taiwan

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## Introduction

Taiwan is located at a complicated tectonic boundary. Arc-continent collision is ongoing and has generated anomalous geothermal gradients in the Central Range. Hydrothermal activities, hot springs, natural gases are abundant in different tectonic domains. Hence, identification of fluid sources, based on helium isotopic ratios, may provide important information to constrain the magmatic and tectonic evolutions in this area.

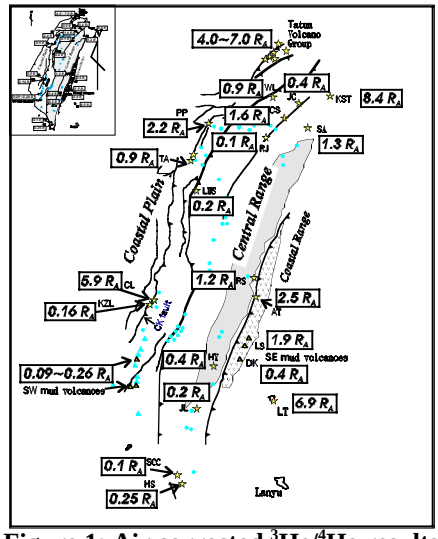


**Figure 1: Air corrected $^3$He/$^4$He results in Taiwan.**

## Discussion and conclusions

According to the tectonic setting, the fluid samples can be divided as three groups with a few exceptions.

(1) Igneous province: Tatun Volcano Group (4.0~7.0$R_A$), and KST (8.4$R_A$), LT (6.9$R_A$) hot springs are believed magma related in origin. Mantle component (8$R_A$) played an important role in these samples. Samples from other province but close to these areas may have been affected and hence show higher $^3$He/$^4$He ratios.

(2) Central Range province: Most data (WL, JC, RJ, LUS, HY, JL hot springs) range from 0.1 to 0.9$R_A$. This can be well explained by mixing of crustal component (<0.1$R_A$) and air saturated water (1.0$R_A$).

(3) Coastal Plain province: Expected crustal signatures can be obtained in SW mud volcanoes and KZL hot springs (0.1~0.26$R_A$). This indicates a crustal source was dominant in this area. However, some unusually high ratios were obtained in PP (2.2$R_A$), TA (0.9$R_A$) and CL hot springs (5.9$R_A$) which suggests that the mantle source component also play an important role, although no magma activity has been known in this area since the late Miocene.

# Abnomal enrichment of selenium in Yutangba carbonaceous cherts, Southeast Enshi, Hubei Province, China

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In the carbonaceous cherts at the top of the Lower Permian Maokou Formation limestones at Yutangba, Shuanghe Town, southeast Enshi city, Hubei Province, the element Selenium is so abnormally enriched as to have formed an independent Se deposit, and the main ore type of the Yutangba Se deposit are seleniferous cherts, which constitute the dominant seleniferous layer of the Yutangba Se deposit. The cherts contain as much Se as 1646 _ $10^{-6}$ on average. In addition, they are rich in organic carbon, $Al_2O_3$, $Si_2O$, but poor in S. In addition to Se, as well as Mo, Cd, V, Co, etc are also highly enriched in the cherts. The chert samples are characterized by low _REE, slight LREE enrichment, relatively heavy Si isotope enrichment, and insignificant variations in _$^{30}$Si value within the range of 1.1‰ ~1.2‰. Generally it can be judged from the major element, trace element and REE data and the Si isotopic characteristics that the Yutangba seleniferous cherts were formed in the shallow sea to semi-deep sea anoxic environments and their formation is controlled chiefly by bio-chemical processes.

We have come to the following conclusions in regard to the mechanism of formation of the Yutangba Se-rich cherts. The Dongwu movement, which had occurred in the late Early Permian, led to the gentle uplift of the crust in the region studied. Owing to the difference in extent of crustal uplifting the relatively closed and stagnant anaerobic conditions were created in the basin. Moreover, the effusion of Emeishan basalts in Southwest China was accompanied with limited sea-floor hydrothermal activities and volcanic eruption. These distal-source magmas and hydrothermal activities brought about large quantities of Si and Se. Under such circumstances the original normally cycling mechanism would necessarily be destroyed and the dynamic balance would be broken, thus leading to vast reproduction of siliceous planktons (mainly plankton plants) to consume the excess Se and Si. Meanwhile, these organisms would die rapidly and be precipitated on the sea floor to form Se-rich carbonaceous cherts.

## References

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