

## Weathering Induced Fertile Continents for Tungsten Deposit

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Global distribution of tungsten deposit is extremely localized, with ~90% produced from only three regions worldwide, especially in South China [1]. However, the reason for such a localized distribution is enigma. Most tungsten deposits are related to highly-evolved granites while the highly evolved granites do not necessarily generate tungsten deposits.

It has been proposed that weathering of the basement rocks probably play an important role in the enrichment of tungsten [2]. Tungsten might be enriched in the intensely weathered rocks either as in-situ weathering residues or by later adsorption of the dissolved W onto clay minerals. The hydrated sedimentary rocks may also increase the degree of magma evolution, helping to enrich the tungsten.

Here we show that the basement of the tungsten ore bearing granites in South China is highly weathered according to the  $\delta^{18}\text{O}$  value and Hf model age of the zircons. Generally, zircons with high  $\delta^{18}\text{O}$  value manifest that source rocks having gone through intensive surficial alteration. Mixing processes during the surficial weathering also homogenized the Hf model age of the crustal materials to the mean age of the continental crust. The high average  $\delta^{18}\text{O}$  value of our more than 5000 globally collected detrital zircons falls into the Hf model age of 1.5-1.8 Ga, which is close to the average continental crust, suggesting the weathering control of both  $\delta^{18}\text{O}$  value and Hf model age.

Data collection in South China showed that zircons in the tungsten-bearing granite are characterized by both high  $\delta^{18}\text{O}$  value and Hf model age of Paleoproterozoic (1.5-1.8 Ga). We suggest such characteristic reflect intensive weathering of the basement rocks in South China. The highly weathered basement may explain why all stages of magma activity in South China could generate the tungsten ore. Lacking of the weathering basement may also explain why there's no such giant tungsten ores in other granite regions of the world.

[1] Pilar Lecumberri-Sanchez *et al.* (2017) *Geology* **45**, 579-582. [2] Romer & Kroner (2015) *Mineralium Deposita* **50**, 327-338.