

## **The millennium eruption of Changbaishan volcano in northeast China: High-precision wiggle-match radiocarbon chronology and implications**

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The 10<sup>th</sup> century AD eruption (or so-called millennium eruption) of Changbaishan volcano, located at the border between China and North Korea, is one of the biggest (VEI 7) on Earth over the past 2,000 years. However, the exact timing of the event has been under intense debate for nearly three decades and no unambiguous and consensus radiometric chronology exists for the eruption at present. In this study, we report a new accurate and precise chronology of AD 946 ± 3 for the millennium eruption, which was derived from radiocarbon wiggle-match dating of a 264-year old tree trunk (with bark) buried in the pyroclastic flow deposits of Changbaishan volcano. High-precision radiocarbon measurements were made on 27 sequentially sampled annual rings of decadal intervals with analytical precision of ± 25 <sup>14</sup>C years, on this 260-year tree-ring sequence that covers three consecutive wiggles around AD 910, AD 785, and AD 730. Since longer dated tree-ring sequence, finer sample resolution and higher <sup>14</sup>C analytical precision all facilitate more and tighter tie-points for better WM dating, our new date is believed to represent yet the best high-accuracy and high-precision <sup>14</sup>C WM chronology for the Millennium eruption. Moreover, this new age conforms perfectly to the exact date of AD 946 inferred from Korean and Japanese historical documents and therefore should end the decades-long debate about the timing of the eruption. No stratospherically loaded sulfate spike that was likely associated with the eruption is found in the global volcanism record from the GISP2 Greenland ice core, suggesting that the millennium eruption was a Toba-like "ash giant/sulfur dwarf" and thus had much smaller climatic impacts than implied by its magnitude in the northern hemisphere (compared to the climatic impact of the 1815 Tambora eruption that also has a magnitude of VEI 7). Our new chronology will serve as a solid knowledge basis for better understanding of the recurrence interval and eruptive risk of this potentially most destructive volcano in northeast China.