Pt-Os geochronology constraints of a Cu-Pt-rich ore body in the Jinchuan intrusion, China: dating hydrothermal overprinting and the final emplacement of the deposit

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The Jinchuan ultramafic intrusion in northwest China is ranked the world's third largest magmatic Ni-Cu sulfide deposit. The Jinchuan intrusion has been dated at ca. 825 Ma by U-Pb method using zircon and baddeleyite. The age obtained by Re-Os method for massive ores is similar to the age of the intrusion. This age is considered to record the timing of crystallization of the intrusion and the main stage of ore formation. The Jinchuan intrusion shows a tectonic contact with its immediate country rocks and is believed to have been thrust to its present location by a regional tectonic event. Besides the main ore body consisting of net-textured and disseminated sulfides, there is hydrothermal mineralization associated with sheared contact zones of the intrusion, which shows elevated Cu and Pt concentrations. In this study, we applied the Pt-Os chronometer to a Cu-Pt-rich ore body, yielding an isochron age of 436 ± 22 Ma. This age is significantly younger than the main ore formation age of about 825 Ma, but similar to the continental collision event of the orogenic belt between the North China Craton and Qadam-Qilian Block. This indicates that the intrusion may have been uplifted to the present location in the orogenic process, which generated the Cu-Pt-rich hydrothermal ore body. Our new data provide the first precise age indicating the time when the Jinchuan deposit was thrust to its present location from depth. This study shows that the Pt-Os isotope system is a powerful tool for dating hydrothermal overprinting of Ni-Cu-(PGE) sulfide deposits.