

## Geophysical imaging of the crust below the early Archaean Barberton Greenstone Belt, South Africa

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The Barberton Greenstone Belt (BGB) in the eastern part of the Kaapvaal craton is one of the oldest and best preserved early Archaean greenstone belts on Earth and has been a subject of intense international study for about 50 years, ever since the first komatiites were discovered. Its excellent preservation and high economic potential (more than 350 tonnes of gold were mined since 1882) led to numerous studies relevant to early Earth evolution, including the origin and evolution of komatiites, as a proxy for early mantle conditions, early life as preserved in chert horizons, the depositional environment of volcanic rocks and clastic sediments as well as the petrogenesis of the tonalite-trondhjemite-granodiorite (TTG) suite surrounding and intruding the BGB. The tectonic setting of the BGB has been a matter of intense debate and controversy, in particular because its original base is nowhere exposed, and deformation and metamorphism have obscured much of the original relationships. Models range from a rift-related intracontinental setting with a potential basement of TTG gneisses as exposed in the Ancient Gneiss Complex of neighbouring Swaziland to an intra-oceanic evolution where the mafic-ultramafic volcanic assemblage is interpreted as ancient oceanic or plateau-type crust. Much of the speculation on the tectonic evolution continues because the crustal structure below the BGB is unknown, and inferred structural models range from thrusting of the greenstone package onto a granitoid substratum to gravity-induced dome and basin formation with steep structures involving partial convective overturn. The fundamental question of when modern-style plate tectonics began also enters the debate.

In order to probe the deep crust below the BGB we propose to conduct a multidisciplinary and international research project involving seismic surveys and other geophysical techniques across the BGB, involving SinoProbe II of China and other teams as part of a long-term China-South Africa geoscience cooperation initiative. Such surveys will not only help to understand the tectonic evolution of the BGB and, as such, an important and unanswered problem in global Archaean geology, but will also show, for the first time, the structure of the continental crust below one of the model Archaean greenstone belts on Earth. This proposed project will also help to better understand gold mineralization and its relation to tectonic processes.