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Geology of the giant Jiaodong gold province, China

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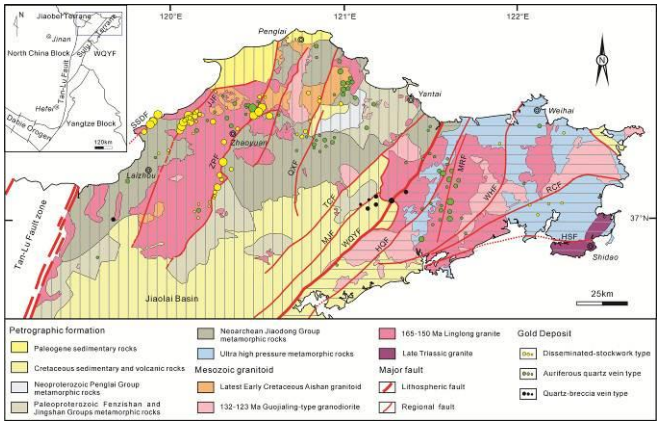
The Jiaodong gold province, with an estimated 4,000 t of contained gold and on the eastern margin of the North China block, is China's largest gold producer. Gold is now recovered from at least 159 mining operations with a combined annual production in excess of 30 t Au per year. More than 95% of the Jiaodong gold resource is hosted by Mesozoic granitoids that intruded high-grade metamorphic basement rocks of the Precambrian Jiaobei terrane in the northwest and Sulu terrane in the southeast. The Jiaodong gold deposits, in common with orogenic gold deposits throughout the world, are structurally-controlled orebodies, and occur along regional NNE-trending fault zones. The NNE to NE-striking splays tend to occur along the margins of the main Linglong suite batholiths or between intrusions of the two suites of granitoids. Many of the larger gold deposits are located along fault jogs on the splays, which is consistent with a regional flow controlled by fluid cycling during seismic events. Main orebodies are present as quartz vein systems (Linglong-type) and as stockwork veinlets and disseminated mineralization (Jiaojia-type). The two mineralization styles are transitional and thus are present within the same gold deposit in many places.



Jiaodong is well recognized as one of the world's great gold provinces, but also is one of the most controversial to classify and difficult to fully understand. Some workers argued these were unique types of gold deposits and should be defined as "Jiaodong-type" deposits. Other workers have referred to these as a "decratonic gold deposit" type. Yet they do have many features that resemble classic orogenic gold deposits, and thus this has led others to

classify these as orogenic gold deposits.

Figure 1: Simplified geological map of the Jiaodong gold province, China

We highlight a number of unique aspects of the Jiaodong gold province, which have been still poorly studied, but may be critical for better defining the ore formation model. First, the gold lodes in the Jiaodong province are ca. 130–120 Ma, but formed in high-grade metamorphic terranes (ca. 2.9–1.9 Ga) more than two billion years after the Precambrian host terranes were devolatilized. The Jiaodong gold deposits are spatially associated with Mesozoic granitoids, mainly the ca. 165-150 Ma suite of Linglong granitoids, which show the same NNE orientation as the ore-controlling faults. The deposits are temporally associated with the ca. 130-123 Ma suite of Guojialing intrusions, but there is no clear spatial association between these Early Cretaceous intrusions and the roughly coeval gold deposits. Secondly, the Jiaodong deposits contain abundant iron, often present as massive pyrite in the gold ore zones. Pyrite in the deposits is an order of magnitude more abundant than this in most typical orogenic gold deposits, which contain no more than 2-3 percent pyrite, pyrrhotite, and/or arsenopyrite. Finally, the gold lodes are surrounded by broad, pinkish (Fe-rich) K-feldspar haloes within the Jurassic granitoids; such haloes appear to be absent in the minority of deposits hosted by Cretaceous intrusions. Therefore, the pink K-feldspar is suggested to be a product of pre-gold alteration, with the iron perhaps contributed from breakdown of magmatic biotite. The areas of Jurassic alteration may define sites of preferential hydrofracturing and sulfidization by low-salinity aqueous-carbonic fluids during the gold event a few tens of millions of years later.