

General Features of Tin Provinces of Russian Far East

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Four tin provinces are defined in Russian Far East. Each of them contains several large ($\geq 50,000$ t), dozens of medium-size (between 10,000 and 50,000 t), and hundreds of small ($\leq 10,000$ t) tin deposits. About 43,000t of tin in concentrate were produced from 1991 to 1995.

Each of the provinces occurs at the junctions of: (1) cratonal or metamorphosed continental margin terranes; (2) accretionary wedge or subduction zone terranes; (3) turbidite basin terranes; and (4) overlap assemblages of calc-alkaline volcanic-plutonic belts.

The ages of tin deposits and related intrusive rocks vary from Devonian to Miocene with maximum (about 94%) in the Cretaceous and Paleocene (from 55 to 138 Ma).

The composition of tin intrusive rocks ranges from diorite, granodiorite, and granite, to leucogranite and granite porphyry. The rocks vary from ilmenite series with $\text{Fe}_2\text{O}_3/\text{FeO} < 0.5$ (84% of the massifs) to magnetite series with $\text{Fe}_2\text{O}_3/\text{FeO} > 0.5$ (16%). The rocks are mostly of I-type with $\text{Al}_2\text{O}_3/\text{Na}_2\text{O} + \text{K}_2\text{O} + \text{CaO}$ (mol) < 1.1 (78% of the massifs), and partly of S-type with $\text{Al}_2\text{O}_3/\text{Na}_2\text{O} + \text{K}_2\text{O} + \text{CaO}$ (mol) ≥ 1.1 (22%). The initial ratio of $^{87}\text{Sr}/^{86}\text{Sr}$ varies from 0.703 to 0.712. The rocks contain Sn from 4.1 to 103.6 ppm.

These granitoids form multiple intrusive complexes. Evolution of the complexes is characterized by gradual change of geochemical features (Sn content, $\text{Al}/(\text{Na} + \text{K} + \text{Ca})$, I^{Sr}_0) from early to late magmatic phases. The complexes are associated with Sn deposits of different types.