

# Chromitites from the Sudetic ophiolite: origin and alteration

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**Abstract:** The presented study was focused on the petrological and chemical features of high-Al chromitites associated with serpentinitized ultramafic rocks of mantle origin in the Jordanów-Gogołów and the Braszowice-Brzeźnica massifs, the Sudetes. These massifs are the fragments of the so-called Central Sudetic ophiolite and are located along the edge of the Góry Sowie massif. The studied chromitites form small, lens-like bodies, hosted by serpentinitized harzburgites and dunites. They were exploited on the turn of the 19<sup>th</sup> century and at the beginning of the 20<sup>th</sup> century; after that they fell into obscurity and no reliable geological data is available on them.

The primary Cr-spinels from the studied chromitites are typical Cr-spinels that precipitated within small-sized magma chambers hosted by the mantle rocks and located close to the Moho zone. The cumulate textures together with pull-apart deformations commonly observed in spinel grains promote the idea of rapid crystallization as a result of supersaturation during dynamic melt-mixing processes. According to the high  $\text{Al}_2\text{O}_3$  contents they can be treated as high-Al chromitites with  $cr\# < 70$ , however the Jordanów-Gogołów chromitites are slightly richer in Cr than the Braszowice-Brzeźnica chromitites. The magnitude and scatter of the  $cr\#$  values and the contents of  $\text{TiO}_2$  supported by the  $\text{Fe}^{2+}/\text{Fe}^{3+}$  atomic ratio of studied Cr-spinels strongly suggests a back-arc setting of formation. The lack of high-Cr chromitites that should occur in the same ophiolitic body may be proof that no mature island-arc structures were present in this area.

After crystallization, the chromitite pods were transported and deformed during ophiolite emplacement. They also underwent extensive alteration, indicated by Fe-enriched rims in spinel grains and transformation of the olivine matrix into Cr-bearing clinochlore assemblage or Cr-bearing clinochlore-serpentine-carbonate assemblage. Chemical composition and optical properties of the altered spinel phases indicate different alteration modes in both localities. Extensive lower-amphibolite facies metamorphism with a minor influence of low-temperature alteration (serpentinitization) are characteristic for the Braszowice-Brzeźnica chromitites, whereas the Jordanów-Gogołów chromitites underwent mostly greenschist-facies processes with the minor participation of higher temperature ones.

Models of the formation of the Sudetic ophiolite have to be revised. The supra-subduction-related origin of the Jordanów-Gogołów and the Braszowice-Brzeźnica chromitites and the surrounding ultramafic rocks suggests that at least part of the Sudetic ophiolite may be classified as a supra-subduction ophiolite instead of MOR-type ophiolite as at present.

**Key words:** high-Al chromitite, Cr-spinel, ferrichromite, Cr-magnetite, Cr-bearing clino-chlore, dunite, harzburgite, serpentinite, alteration, greenschist-facies metamorphism, amphibolite-facies metamorphism, back-arc basin, supra-subduction zone ophiolite, Sudetes.