

perature ranging from 1000°C to 500°C [2]. Only in two cases, djferfisherite was classified as a secondary mineral formed at the expense of magmatic pentlandite during serpentinization [7] and of primary pyrrhotite because of the infiltration of C-poor fluids during a contact metamorphism near 700°C [8]. Our data show that in the Guli complex, djferfisherite occurs within a phlogopite-magnetite-rich clinopyroxenite stock emplaced along the edge of the dunite core complex. The giant dunite complex of Guli is believed to be the result of successive fractional melting of an ascending mantle plume under metasomatic conditions [9]. The clinopyroxenite stocks and dykes are possibly derived from a fractional melt portion of the ascending mantle plume, that had intruded at the periphery of the dunite complex. Djferfisherite and the associated sulfides are part of the accessory assemblage (phlogopite, perovskite-group mineral, apatite, calcite, titanite, plagioclase, zircon, and pyrophanite) formed as a result of this metasomatic event that affected the Guli dunite. The compositional similarity of the Guli djferfisherite with those from alkaline rocks support our proposal that the metasomatic fluids had an alkaline signature.

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THE CHROMITITES AND THE ASSOCIATED PLATINUM-GROUP MINERALS (PGM) OF THE SANTA ELENA OPHIOLITE (COSTA RICA): FIRST AND PRELIMINARY RESULTS

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INTRODUCTION

The composition of chromite from chromitite deposits can be used successfully as an indicator of magma composition [1,2] and geodynamic setting of the host mafic-ultramafic rock. Due to its chemical stability, chromite is well resistant to low temperature alteration processes, therefore is par-

ticularly useful in the identification of the petrologic nature of ophiolitic ultramafic rocks, in which primary silicate assemblages are frequently obliterated by hydrothermal alteration and weathering. Moreover, ophiolitic chromitites contain variable amounts of platinum group minerals (PGM) whose composition and paragenesis may provide further information on chemical and physical parameters during chromitite precipitation and post-magmatic evolution. Small chromitites have been described from the ultramafic portion of the Santa Elena ophiolite in Costa Rica as to field relations and morphology of the ore bodies, although compositional and mineralogical information is lacking [3,4]. In this work, we present the first data on chromite composition and PGM assemblage of these chromitites with the aim to contribute to decipher their petrogenetic significance.

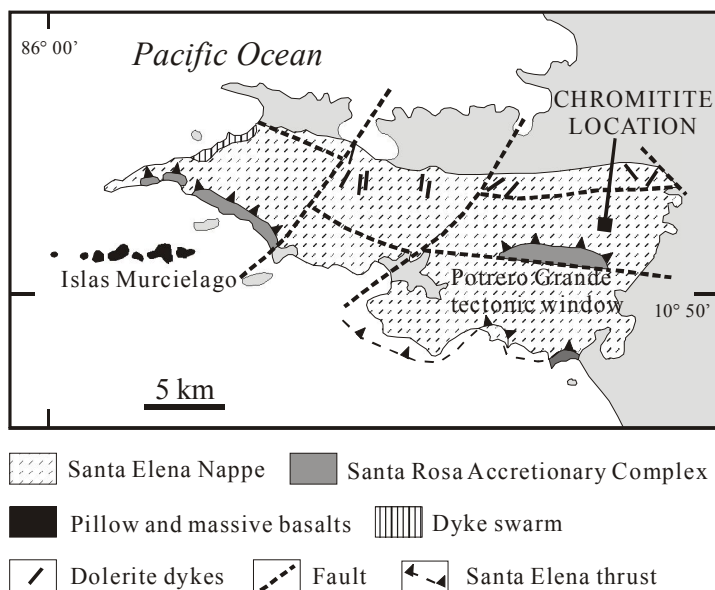


Fig. 1. Geological setting of the Santa Rosa ophiolite and location of the investigated chromitites. Modified after [5,6,7].

GEOLOGICAL BACKGROUND OF THE SANTA ELENA PENINSULA AND DESCRIPTION OF ITS CHROMITITES

The Santa Elena Peninsula is situated in the northern Pacific coast of Costa Rica, close to the border of Nicaragua. It is about 15 km wide and 40 km in a long E-W trend. According to [5,6], it consists of three different structural units (Fig.1): 1) an overthrust allochthonous unit composed of mafic-ultramafic rocks (Santa Elena Nappe), 2) an autochthonous basaltic sedimentary sequence, the Santa Rosa accretionary complex, and 3) Islas Murcielago pillow and massive basalts. The Santa Elena Nappe is mostly composed of partially to totally serpentinized peridotites, mostly diopside bearing harzburgite, with minor plagioclase lherzolite, orthopyroxenite and dunite. Pegmatitic and layered gabbros, plagiogranites and later dolerite dykes cutting across peridotites and pegmatitic gabbros have been also recognized [5,6]. The ultramafic rocks of Santa Elena are considered a relative depleted and metasomatized MORB mantle [6]. The age of radiolarian cherts of the Santa Rosa accretionary complexes varies from Middle Jurassic to Lower Cretaceous, suggesting that the oceanic assemblage beneath the Santa Elena Nappe represents a discontinuous stratigraphic sequence [7].

Six of eight chromitite occurrences previously described [3,4] were sampled and studied in this work. They are located in an area of about 2 km², north of the Potrero Grande tectonic window (Fig. 1). The chromitites are very small and irregular in shape and,

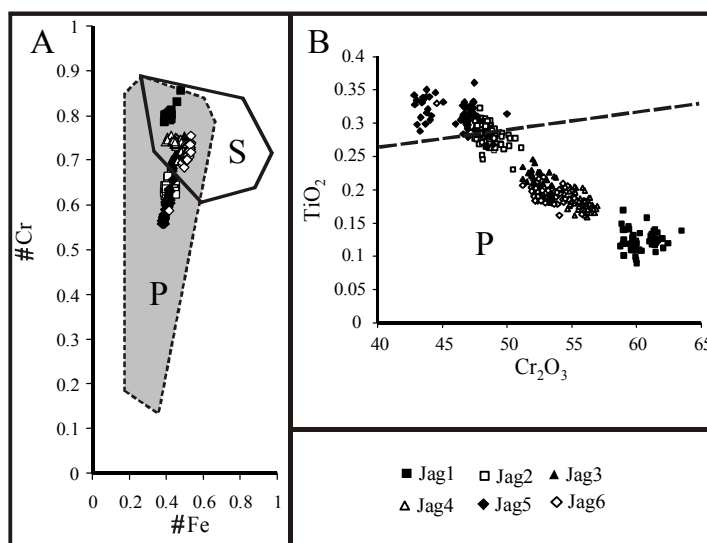


Fig. 2. Chromite composition of the 6 investigated chromitites.

P = podiform, S = stratiform.

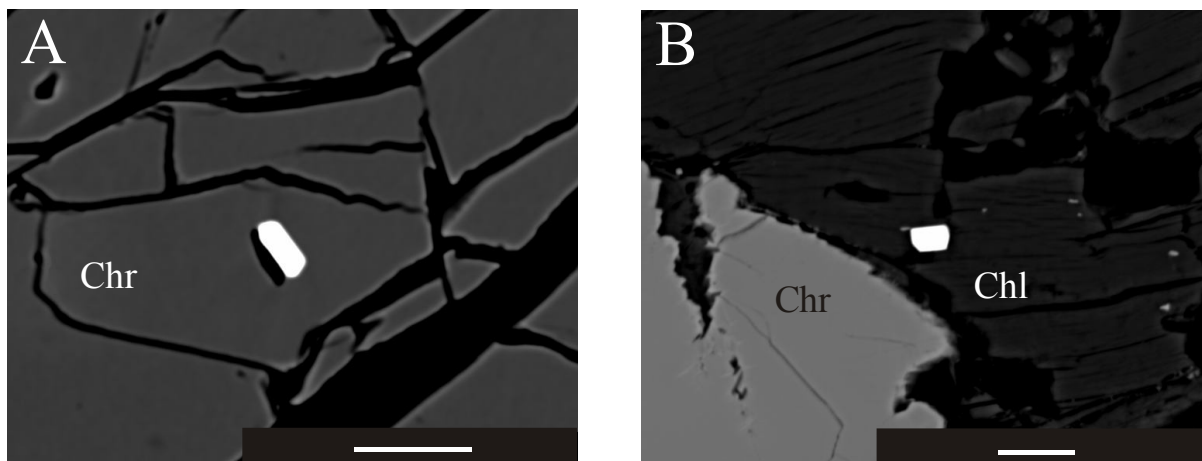


Fig. 3. BSE images of laurite (white grain).

A = Laurite associated with a silicate, included in chromite. B = single phase laurite in contact with chlorite. Abbreviations: Chr = chromite, Chl = chlorite. Scale bar is 10 μm.

owing to the strong lateritic alteration, it was not possible to recognize the nature of the host ultramafic rock. Away from the chromitite outcrops, peridotite with relics of fresh clinopyroxene and gabbros had been recognized. Most of the chromitites are massive however, few examples of orbicular or leopard chromitite have also been identified.

COMPOSITION OF CHROMITE

The chromite appears locally brecciated, but is generally fresh with limited alteration along cracks. The compositions in six distinct localities show gradual transition from aluminous chromite (#Cr = 0.55) to Cr-rich (#Cr = 0.87) (Fig. 2A). The contents in MgO and FeO range between 8-13 and 12-19 wt%, respectively, whereas the amount of Fe₂O₃ decreases from 1.7 wt% to absent. The TiO₂ contents varies from 0.1 wt% up to 0.35 wt%, increasing with decreasing Cr₂O₃ content (Fig. 2B).

THE PLATINUM GROUP MINERALS

The PGM were investigated in situ, using the methodology described by [8]. More than 30 PGM less than 10 μm in size have been identified in 18 polished sections. They form single-phase grains or polyphasic aggregates consisting of one or more PGM, base metals sulfides (BMS) and silicates. Crystal morphology of PGM is generally euhedral even though the PGM occur in fresh chromite or is associated with secondary silicates (Fig. 3). Mineralogy is dominated by Ir-Os-Ru phases, consisting of predominant laurite, accompanied by rare erlichmanite, irarsite, osmium and unknown Ir-Rh-S compounds. The composition of laurite and erlichmanite is shown in the Ir-Os-Ru ternary diagram as atomic % (Fig. 4).

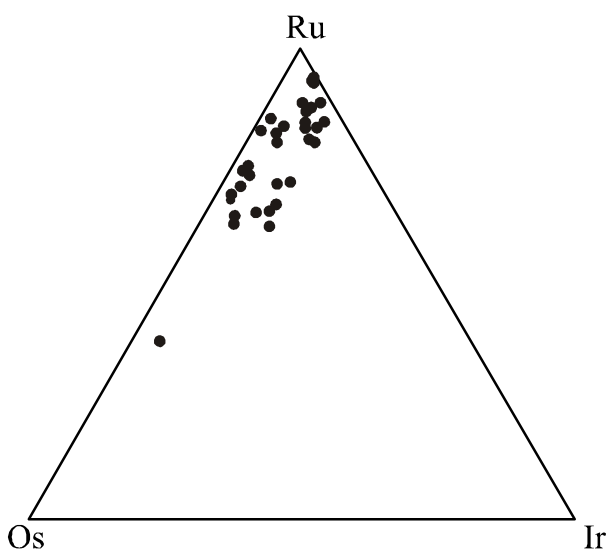


Fig. 4. Composition of laurite-erlichmanite series (at%) in the Ru-Os-Ir ternary diagram.

PRELIMINARY CONCLUSIONS

Preliminary data indicate that the Santa Elena chromitites are compositionally similar to podiform chromitites in ophiolite complexes, except for slightly higher TiO₂ contents. The morphology and texture of the PGM inclusions suggest that most of them are high-temperature magmatic phases entrapped in crystallizing chromite. The Ir-Os-Ru-rich nature of the PGM is consistent

with assemblages observed in many chromitites hosted in the mantle section of ophiolites, although the strong alteration of the host ultramafic rock at Santa Elena does allow conclusive considerations. Similarly to other ophiolites, Cr-rich and Al-rich chromitites occur within the same ultramafic block. The case of Santa Elena, however, is unusual since chromitites with chromiferous, aluminous and intermediate compositions occur in close vicinity (sometimes less than 100 m) forming a continuous trend between the two end members. The significance of this feature is so far under study.

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ХРОМ В АЛЬПИНОТИПНЫХ ГИПЕРБАЗИТАХ АЗЕРБАЙДЖАНА

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CHROME IN ALPINETYPE ULTRABASITES OF AZERBAIJAN

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On the basis of sufficient amount of chemical-analytical material the peculiarities of chrome distribution are studied in the main types, kinds and rock-forming minerals of the Lesser Caucasus ultrabasites. Its balance calculation on minerals shows that it initially is prone to form mineralization during differentiation period of primary substratum and in further it is dispersed as accessory chrome-spinelid. At next stage chrome isomorphically substitute principal components in rock-forming minerals.

Типичный литофильный элемент – хром характерный представитель гольдшмитовского геохимического семейства элементов железа, являющихся когерентными компонентами гипер-