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Evidences of a Magmatic Fluid Circulation Registered in Tourmalines from the Ampliación Pueblo Viejo District (Dominican Republic)

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The Ampliación Pueblo Viejo (APV) project is located in the central portion of the Hispaniola Island in the Caribbean, and surrounds the famous Pueblo Viejo gold deposit, which has estimate reserves of 248.6 million tonnes of ore grading 2.8 g/t Au and 13.4 g/t Ag. The outcropping rocks in APV and those that host Pueblo Viejo's ores belong to the Early Cretaceous Los Ranchos Formation. This unit is part of the oldest and chemically most primitive Circum-Caribean island-arc system and is composed of LREE-depleted tholeiitic island arc basalts and normal island arc tholeiites with an interval of felsic volcanism and plutonism dated at 110-118 Ma.

Pueblo Viejo deposit origin keeps being a controversial topic in economic geology because of the lack of a known porphyry counterpart big enough to drive the hydrothermal cells responsible for gold mineralization. Recent diamantine drill holes in APV digging deeper than 800 m have cut a diorite body that seems to spread out more than 10 km. From thin section study under optical microscope, SEM-EDS and EMPA of more than 40 samples located near to the diorite contact with "Los Ranchos" volcanoclastic sequence, a pervasive alteration showing a complex overprinting was noted. It includes an early sodic-calcic alteration overprinted by propylithic and phyllic alterations (up to two generation of each one have been distinguished) and by a later argillic alteration. Tourmaline occurs cutting all the above assemblages. In order to characterize alteration horizons, and because the great utility as a prospection tool that tourmalines have demonstrated recently for hydrothermal deposits, here we present texture and chemical composition data of APV tourmalines in order to assess the potential that they could present for our study case.

Two types of tourmaline can be distinguished. Type I consists of acicular crystals forming radial aggregates and showing a strong colour change and often occur forming sub-millimetric veins cutting the bulk rock. Type II occurs as aggregates of prismatic rather stubby crystals often grouped forming bundles and appear scattered in the bulk-rock. All analysed tourmalines belong to the X-vacant and alkali groups. Rims of type I tourmalines have higher Ca contents. The remaining tourmalines are Ca-poor and practically occur in the complete range between the X-site vacancy and Na end members. APV tourmalines belong to the dravite and magnesio-foitite tourmaline species, the last being extremely Fe-poor. A tendency towards Fe and Na enrichment is observed in rims whereas cores are Mg and X-site vacancy richer.

Tourmaline composition is thought to be governed largely by the composition of the hydrothermal fluid, being Fe-rich tourmalines often associated with magmatic hydrothermal fluids whereas Mg-rich ones are related with seawater. Likewise, high Na content in tourmaline reflects high salinities. Thus, chemical evolution of APV tourmalines indicates a trend toward increasing magmatic hydrothermal influence. Further geochemical data is necessary to demonstrate a genetic relation between this magmatic fluid registered by tourmalines and the diorite body; if so, it would represent the first evidence that this body was able to generate fluid circulation and probably to redistribute ores.