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Jade in the Serpentinite Mélanges of the Rio San Juan Complex from the Dominican Republic

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New occurrences of jadeitite, jadeite quartzites, and jadeite-lawsonitequartzites have recently been discovered in the Rio San Juan Complex (RSJC) of the northern Dominican Republic. These rocks are found in serpentinite mélanges associated with a former intra-oceanic subduction zone (Fig. 1). The mélanges contain blocks of various high-pressure (HP) metamorphic rock types such as blueschist, eclogite, jadeitite, orthogneiss, rare cymrite-bearing rocks, marble and metapelite.

Comprehensive petrological studies of different types of eclogite and blueschist reveal a broad diversity of PTt-paths which are closely interrelated. In the early stages of the evolution of the subduction zone, PT-paths are both clockwise and anticlockwise with low ("warm") P/T-gradients; maximum PT-conditions derived from eclogites are about 800°C/2.5 GPa (a Lu-Hf-age on eclogite is 103.9 Ma). Omphacite-bearing blueschists document a continuous cooling and steepening of the PT-gradient; their recorded peak metamorphic conditions are 500-550°C/1.6-1.8 GPa at 80.3 Ma (Rb-Sr on Phe-Amp-WR). Very steep ("cold") P/T-gradients are derived from jadeite blueschists; Rb-Sr-ages (Phe-Amp-WR) of 62.1 Ma and Ar-Ar ages of 71.9 Ma date the peak metamorphic conditions of 360-380°C at about 1.7 GPa (Krebs et al., 2011).

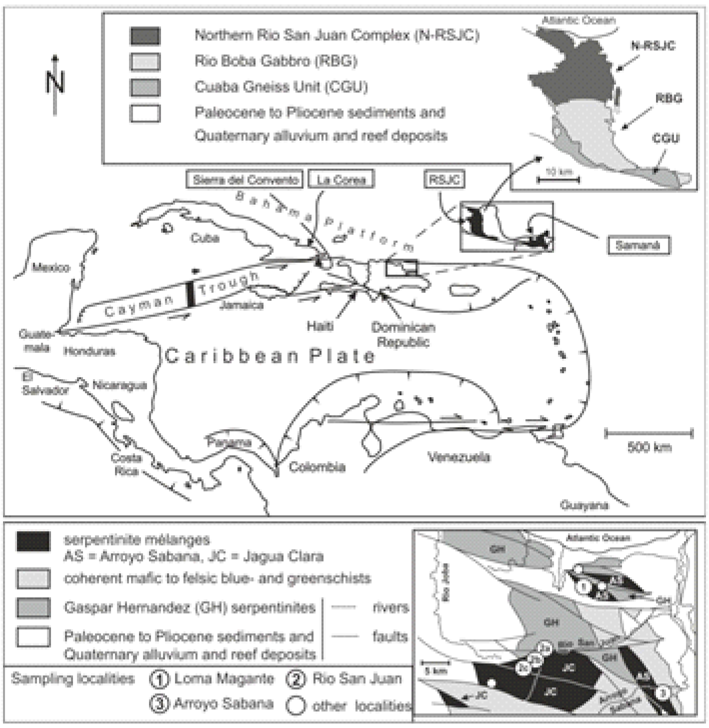

Fig. 1 Sketch map of the Caribbean area and the location of the Rio San Juan Complex (upper inset). For major localities of jadeite-rich rocks see lower inset (modified after Schertl et al., 2012)

Jadeitites are known from only about 20 localities worldwide. They are thought to either crystallize directly from HP aqueous fluids or to form by metasomatic replacement of a suitableprotolithsuch as, for example,tonalite, trondhjemite or plagiogranite. A very unusual feature of the jadeitites of the RSJC compared to other jadeitites worldwide is that, in addition to isolated blocks in the serpentinite mélange, they also occuras layers and veins in jadeite-lawsoniteblueschist and omphacite-garnet blueschist country rocks. The principal types of jadeite-bearing rocks observed in the RSJC can be categorized as (1) jadeititess. str. (quartz-free, albite-bearing, > 90 vol% jadeite), which have so far been found only as loose blocks/boulders in the mélange, and (2) jadeititess.str. (quartz-bearing) and jadeite quartzites (JQ) which grade into jadeite-lawsonitequartzites (JLQ) and even lawsonitequartzites (LQ); whilealso occurring as loose blocks/boulders, these can form concordant layers and discordant veins within blueschists. In addition,monomineralicomphacitite veins have also been found in such blueschists.The rocks exhibit various shades of green, are fine- to coarse-grained (generally 0.1-2 mm), and usually equigranular; they are generally isotropic, but may also be foliated. The mineral distribution is homogeneous in jadeitites.str.

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and JQ, but often patchy in JLQ, giving this rock a mottled appearance. Minerals in both rock suites are jadeite, omphacite, phengite, glaucophane, albite, as well as rare garnet and paragonite. Epidote, titanite, rutile and zircon are important carriers of REE and trace elements.Calcite, apatite and pumpellyite appear restricted to jadeitites.str.

Initial studies of zircon from an allochthonous block of jadeitites.str. without quartz, glaucophane, orlawsonite showed them to contain inclusions of high-pressure matrix minerals such as jadeite and omphacite (Fig.2), interpreted by Schertl et al. (2012) to indicate coeval zircon growth at these HP conditions. The cores of the zircons yield ages of 114.9±2.9 Ma, thus defining a crystallization age close to the initiation of subduction in the Rio San Juan Complex, when "warm" geotherms of ≈15°/km prevailed.The origin of the brightly luminescing outermostdomains of these zircons at 93.3±6.9 Ma is less clear. New data on zircon grains separated from ajadeitite layer (Hertwig et al., 2014) showoscillatory zoned CL-dark zircon domains which exhibit an age of 117.1±0.9 Ma, whereasthe ages of CL-bright domains differ significantly from the dark ones (77.6±1.3 Ma). Zircon grains from the jadeitite-hosting blueschist are oscillatory and patchy under CL and slightly younger (113.6±1.1 Ma) than the CL-dark domains of the jadeitite layer.REE spectra of the dark 117.1 Ma zircon domains from the concordant jadeitite layer appear to indicate that these were inherited from a magmatic protolith; the 77.6 Ma old domainsare probably metamorphic and grew during the formation of jadeite.With the current data at hand it is difficult to say ifthe HP jadeite and omphaciteinclusions in zircons from the allochthonous block of jadeitites.str.mightactually be so -called "pseudo-inclusions", i.e. formed metasomatically insidetheinherited magmatic zircon (Zhang et al., 2009).

The unusual diversity of jadeite-bearing rocks in the RSJC, in context with their observed contact relationships with different blueschist country rocks, reflects their formation at different PT-conditions (350-500° C at minimum pressures of about 1.5 GPa and 500-600°C at ca. 1.1-1.5 GPa) over an extended time span of tens of millions of years in a continuously evolving subduction-zone environment. In addition, evidence for both crystallization directly from a HP aqueous fluid as well as formation by metasomatic replacementis found.

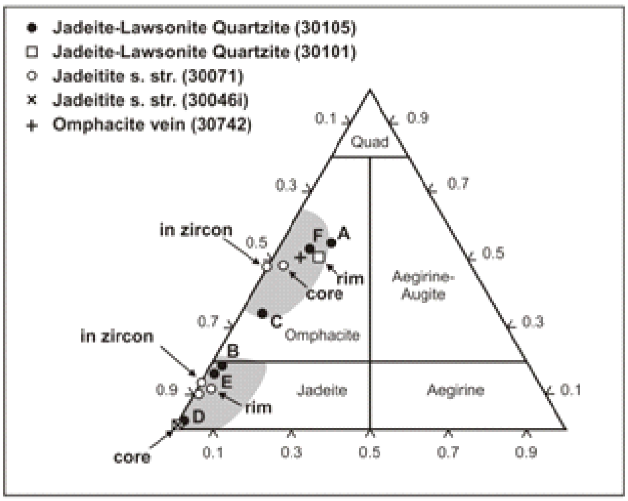

Fig. 2 Variation of jadeite and omphacite compositions (shadedareas) from different jadeite-bearing rocks (as well as inclusions within zircon) of the RSJC in a Quad-Jd-Aeg diagram after Morimoto et al. (1988). Numbers in brackets and characters A to F refer to samplenumbers and to compositions of zoned sodicclinopyroxenesdetermined by Schertl et al. (2012)

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