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Protrusion of fore-arc mantle serpentinites together with HP and UHP rocks along major strike-slip fault zones, Northern Subduction Complex, Hispaniola

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Fig. 1

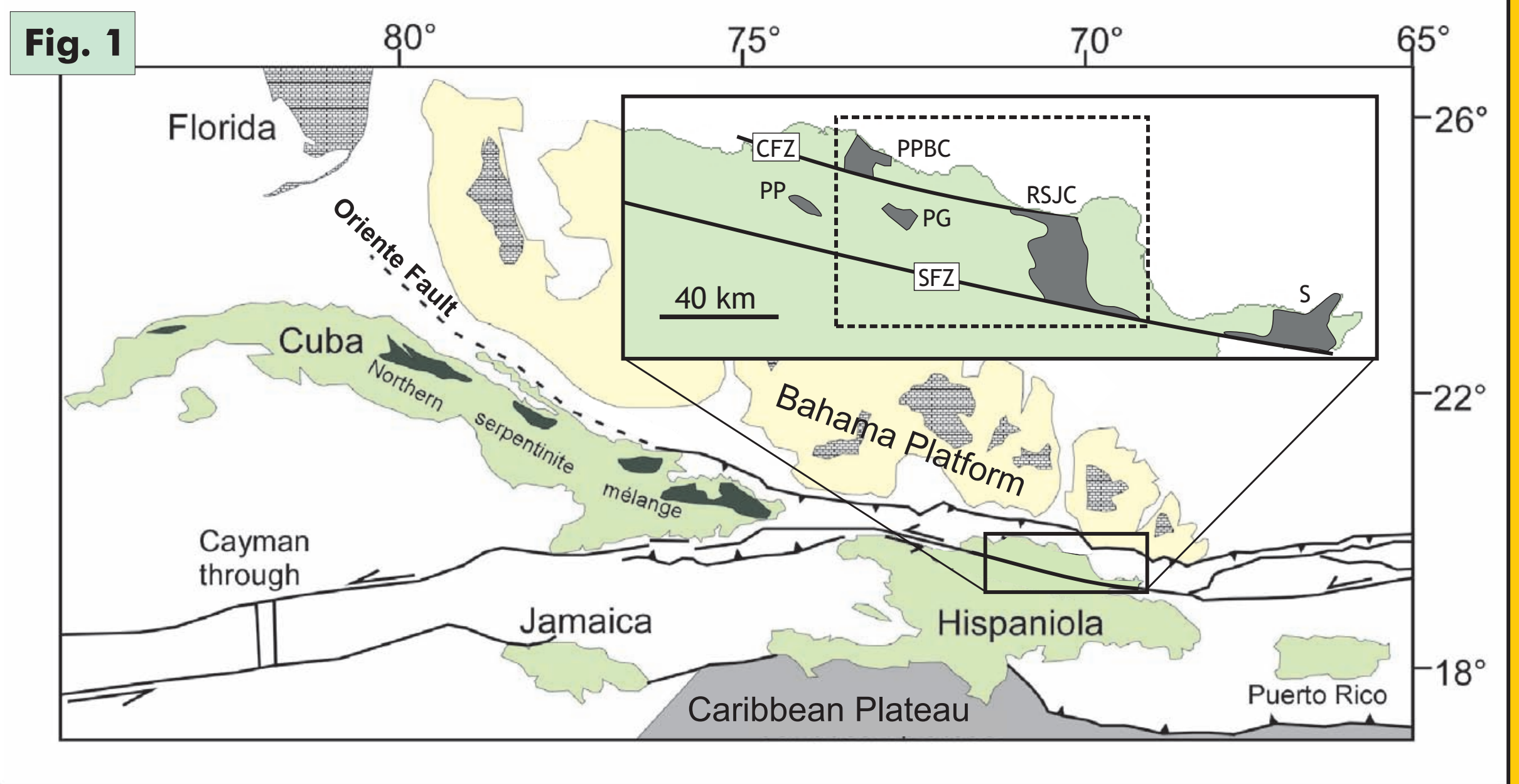


Fig 1) Map of the northern Caribbean [11], where the Bahama Platform (North American Plate) has collided with the Caribbean Plate. On the inset, major faults and inliers exposing Cretaceous to mid-Eocene basement in Northern Hispaniola are highlighted. Arc volcanic and intrusive rocks are exposed in Pedro Garcia (PG) and Palma Picada (PP), whereas a blueschist bearing carbonate-rich melange is found in the Samaná Peninsula (S) [6]. Refer to fig 2 for study area shown with dotted lines.

Petrology & Mineralogy

	Mineral Assemblages	*Primary Minerals*
▲ Northern Terranes	lizardite + magnetite	Cr-spinel
△ Camù Fault Zone	lizardite + magnetite	rare OPX (En91.4) Cr-spinel
◆ HP-LT Melanges	antigorite + talc + tremolite ± chlorite	rare OPX (En90.3) rare Olivine (Fo89.5)
○ Septentrional F. Z.	antigorite + talc + tremolite ± chlorite overprinted by liz + mag	rare OPX (En91.3) rare Olivine (Fo90.8) Cr-spinel

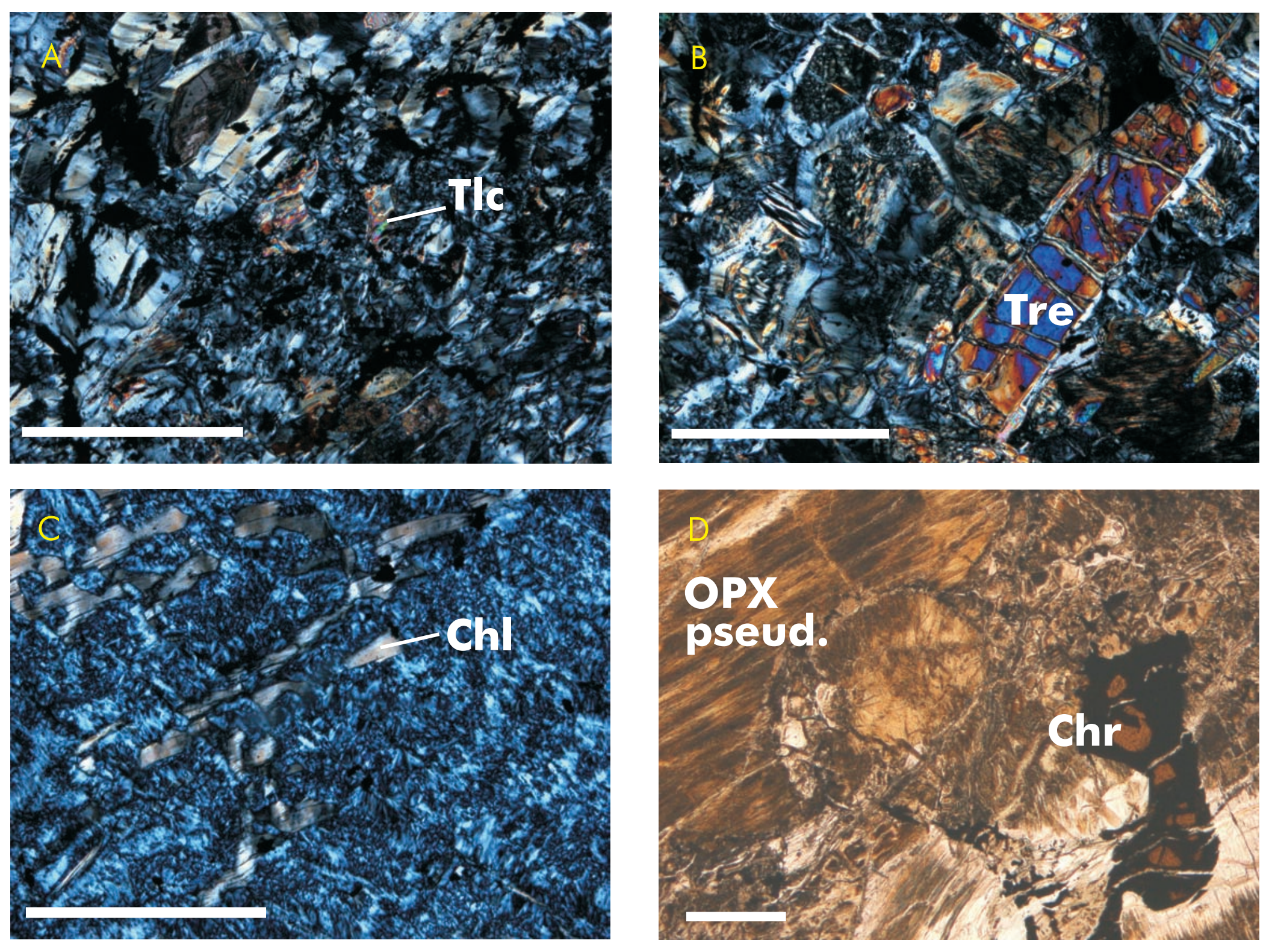
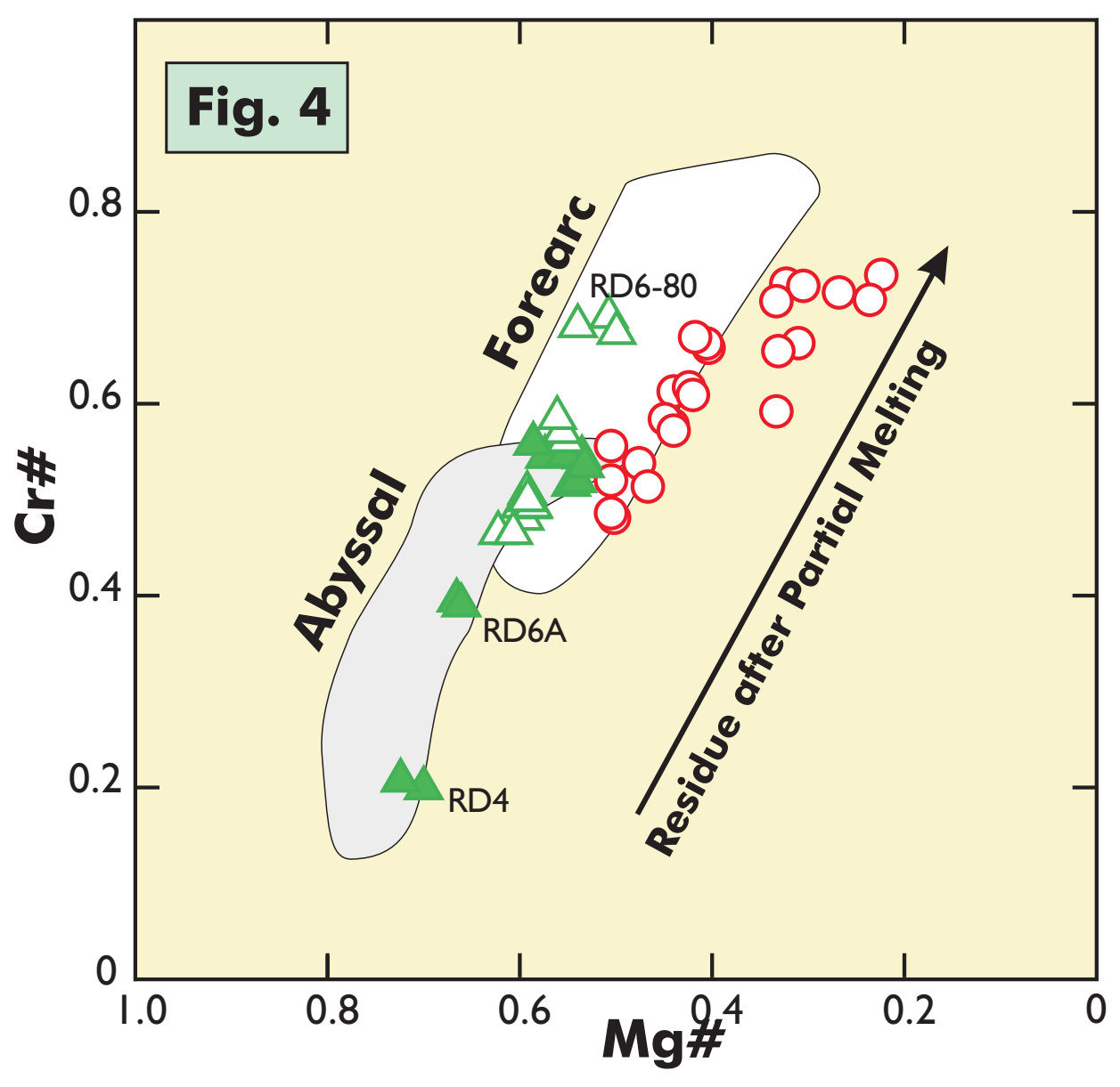


Figure 3: photomicrographs; white lines = 0.5mm; A) Flaky lizardite, fine grained lizardite (prev. Antigorite?), With small highly birefringent talc (RD34a, SFZ), crossed(x)-polars; B) blady tremolite in lizardite matrix (RD6-36a, SFZ), x-polars; C) chlorite in blady antigorite matrix (RD89, HP-LT mel.); x-polars, D) Orthopyroxene bastite and Cr-spinel rimmed by late magnetite (RD4, N. ter.), parallel polars.

Cr-Spinel Composition



Spinel Formula: XY_2O_4

$Cr\# = Cr / (Cr + Al)$
$Mg\# = Mg / (Mg + Fe^{2+})$

Fig. 4) Each data point represents the core of one grain. Data sources for abyssal peridotites [8] and forearc peridotite [12].

Introduction

Serpentinites are key in the understanding of subduction and exhumation geodynamics. They contain up to 13wt% of water and are stable down to depths of 130 km [1]. Peridotites are hydrated to form serpentinites at the base of the mantle wedge because of the release of fluids from the slab and sediments. The dehydration of these serpentinites may be responsible for deep seismic activity [2] and partial melting in the interior of mantle wedges forming arc magmas [3]. Furthermore, because of their low density and viscosity compared to surrounding rocks, serpentinites may assist the exhumation of high (HP) and ultrahigh pressure (UHP) metamorphic rocks [4].

In this study, we document bulk rock compositions and mineral chemistry of serpentinites cropping out in the Northern Subduction Complex of Hispaniola. We discuss the origins of the serpentinites and implications for subduction and exhumation processes along the northern Caribbean plate margin.

Regional Geology and Tectonics

From the Early Jurassic up to the Mid-Cretaceous, divergence between North and South America was accommodated in part by slow-spreading at the Proto-Caribbean Ridge [10]. Subsequently, between the Late Cretaceous and the Mid-Eocene, Proto-Caribbean oceanic lithosphere (part of the North American Plate) was subducted under the east migrating Caribbean Plate. Oblique collision of the Bahama Platform has since resulted in left-lateral strike-slip faulting which formed the Septentrional Fault Zone (SFZ) and the Camù Fault Zone (CFZ) [6,10].

Serpentinites crop out within the Puerto Plata Basement Complex (PPBC) and the Rio San Juan Complex (RSJC), which were continuous before 60 km of strike-slip displacements along the CFZ [5,6]. Metamorphic grade in these terranes increases from north to south: from the low metamorphic grades in the serpentinite melanges in the PPBC and northern RSJC, to the blueschist and eclogite bearing serpentinite melanges in central RSJC, to the retrograded eclogites of the Cuaba Unit which contain lenses of UHP-garnet peridotite [7] in the southern part of the RSJC (figure 2). In addition, serpentinites are concentrated near the CFZ and the SFZ which bound the inliers.

Platinum Group Elements

Fig. 5

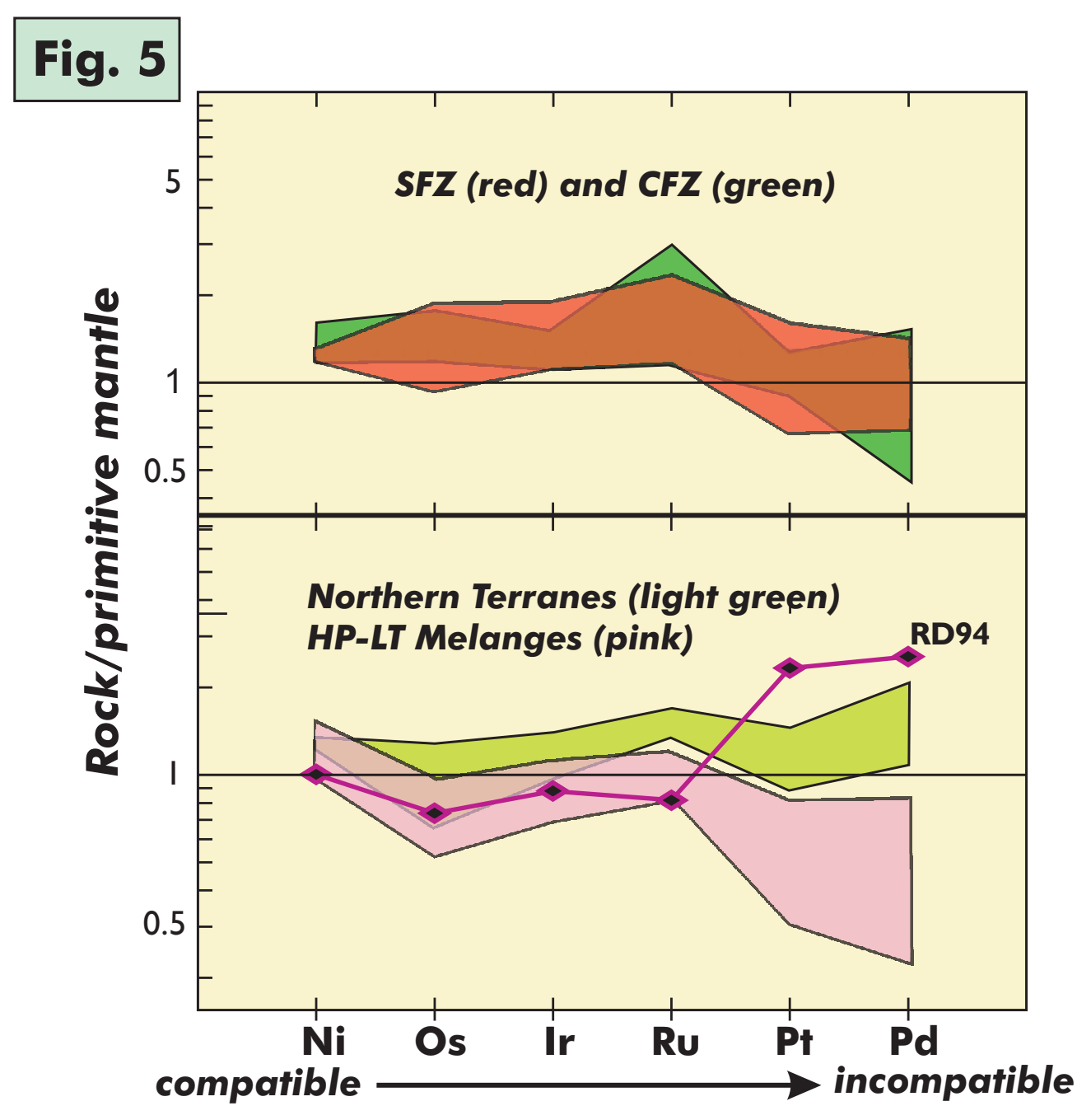
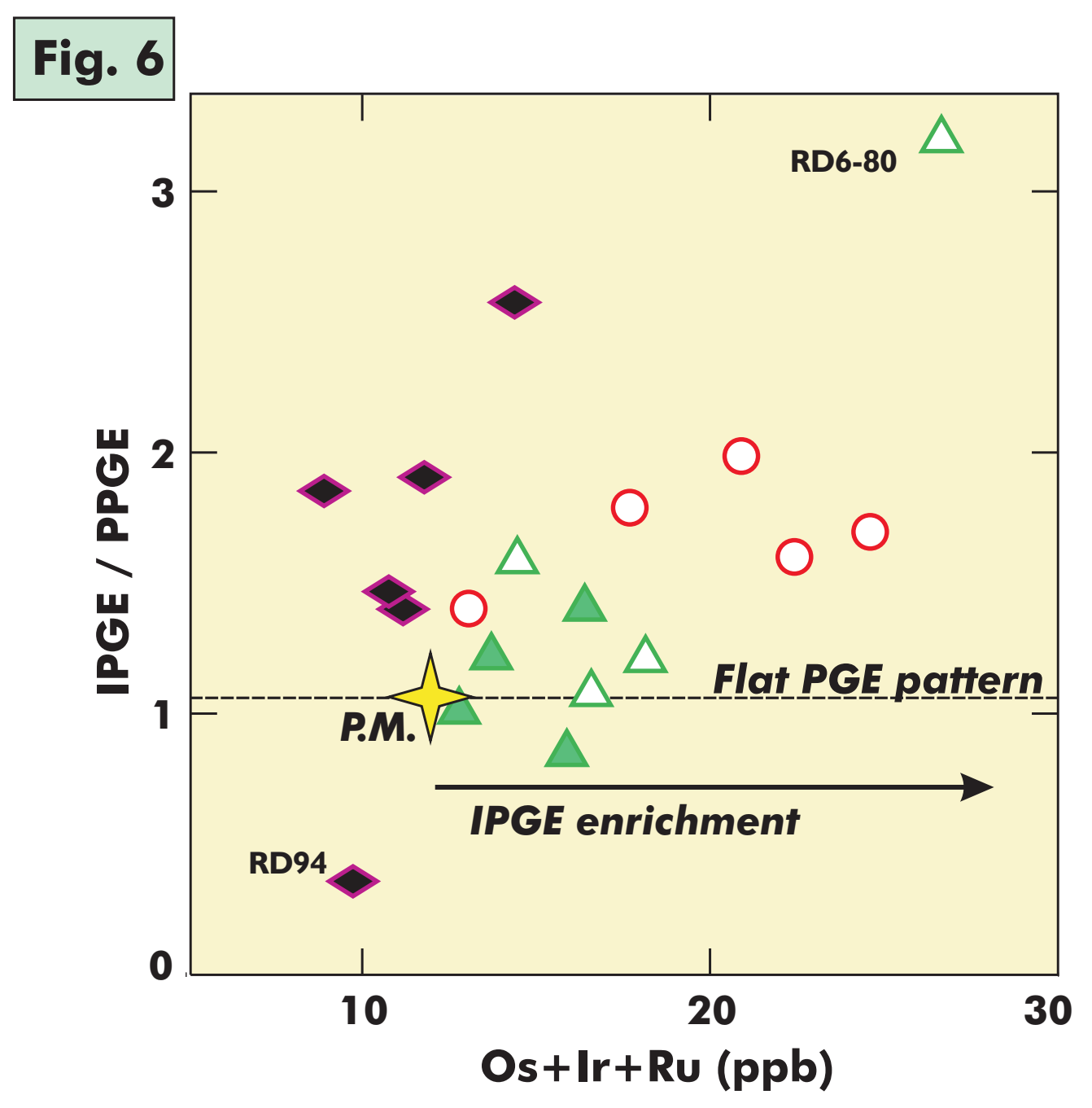


Fig. 6



Results

All studied samples from the Northern Subduction Complex of Hispaniola are interpreted as mantle residues based on their depletion in incompatible elements, the high Mg contents of preserved primary silicates, and their relatively flat to PPGE-depleted PGE patterns.

However, samples from the SFZ and the CFZ show a higher degree of depletion than samples from the Northern Terranes and the HP-LT Melanges: they have depleted bulk composition and Cr#'s in spinels similar to forearc peridotites and they have relatively higher contents of IPGE's. SFZ and CFZ serpentinites originated from the forearc mantle, whereas those from the Northern Terranes and the HP-LT Melanges were abyssal peridotites.

Conclusions

The Proto-Caribbean lithosphere was generated at a slow-spreading ridge (2 cm/yr; [10]): therefore, abundant peridotite was exposed on the sea floor. This is consistent with the high proportion of hydrated abyssal peridotite in the RSJC. During subduction, the buoyant and ductile oceanic serpentinite was exhumed together with blueschist and eclogite blocks to form the HP-LT Melanges of the RSJC.

Forearc serpentinites formed at the base of the mantle wedge. The occurrence of these serpentinites along post-collisional strike-slip fault zones suggests that they used these zones of weakness for protrusion.

Blueschist blocks occur in serpentinite melanges near the CFZ [5,6] and were incorporated during protrusion. Furthermore, serpentinites from the SFZ are spatially associated with eclogites and garnet peridotites. The evidence suggests that forearc serpentinites contributed to exhumation of HP and UHP rocks during active subduction and during late post-collisional transpression.

Fig. 2

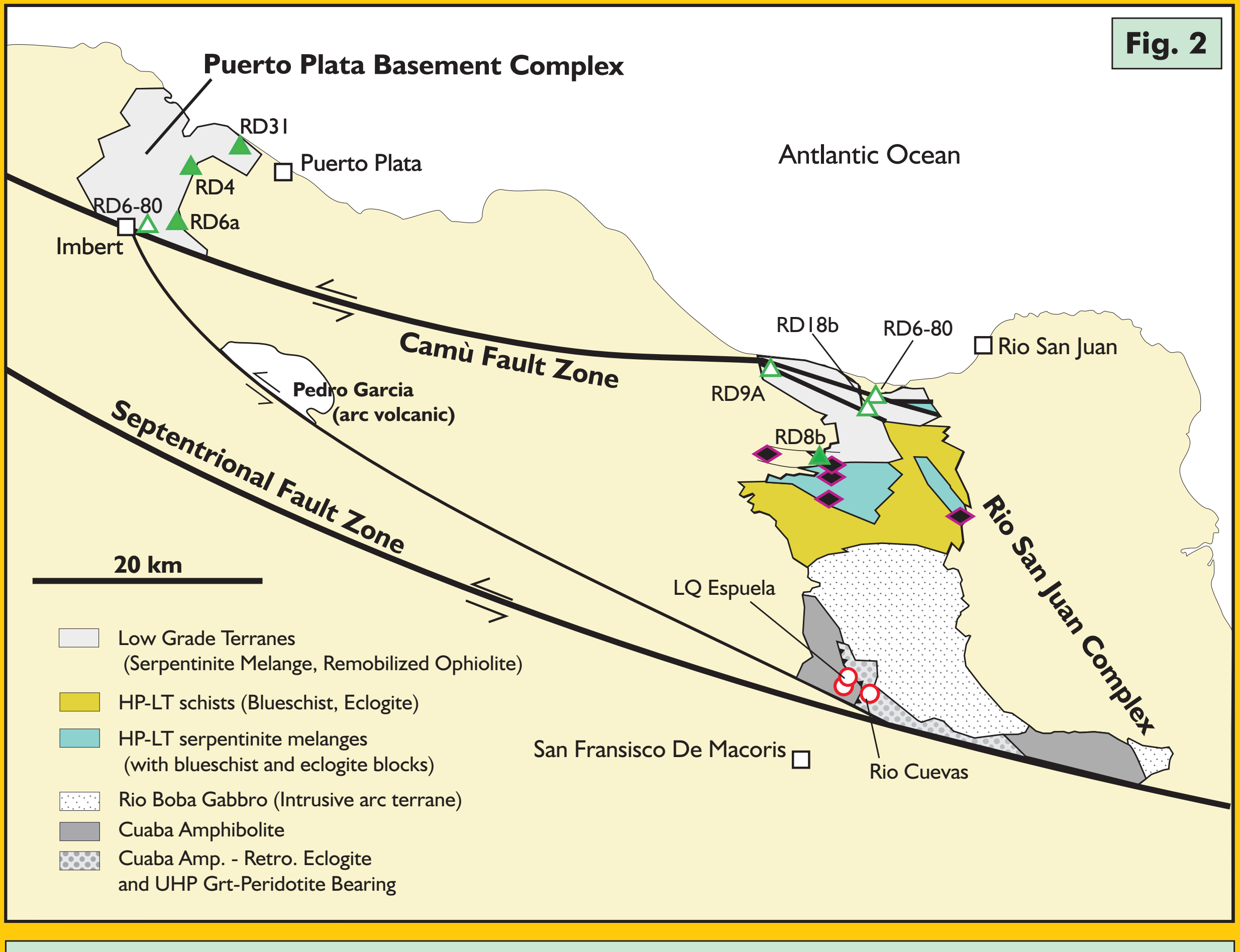


Fig 2) Gereral geology and sample location in study area [5,6,7]. Beige areas represent Neogene to Quaternary sedimentary cover. Samples are devided by thier locality of occurence: (1) near the SFZ, (2) near the CFZ, (3) in the Northern Terranes cut by the CFZ and (4) in the HP-LT melanges of central RSJC. Symbology is consistent throughout this poster.

Theory: Possible Origins of Serpentinites in Subduction Complexes

1) Abyssal Peridotite exposed and hydrated on the sea floor
   Refractory compositions, moderate Cr# in spinels, high in IPGE's

2) Forearc Peridotite hydrated at the base of the mantle wedge by fluids from slabs and sediments
   Highly refractory compositions, high Cr# in spinels, very high in IPGE's

3) Hydrated ultramafic cumulates from the oceanic lithosphereor the forearc
   Enriched in incompatible elements, low in Ni, Cr and IPGE's
   NOT observed in this study...

Bulk Rock Chemistry

Fig. 7

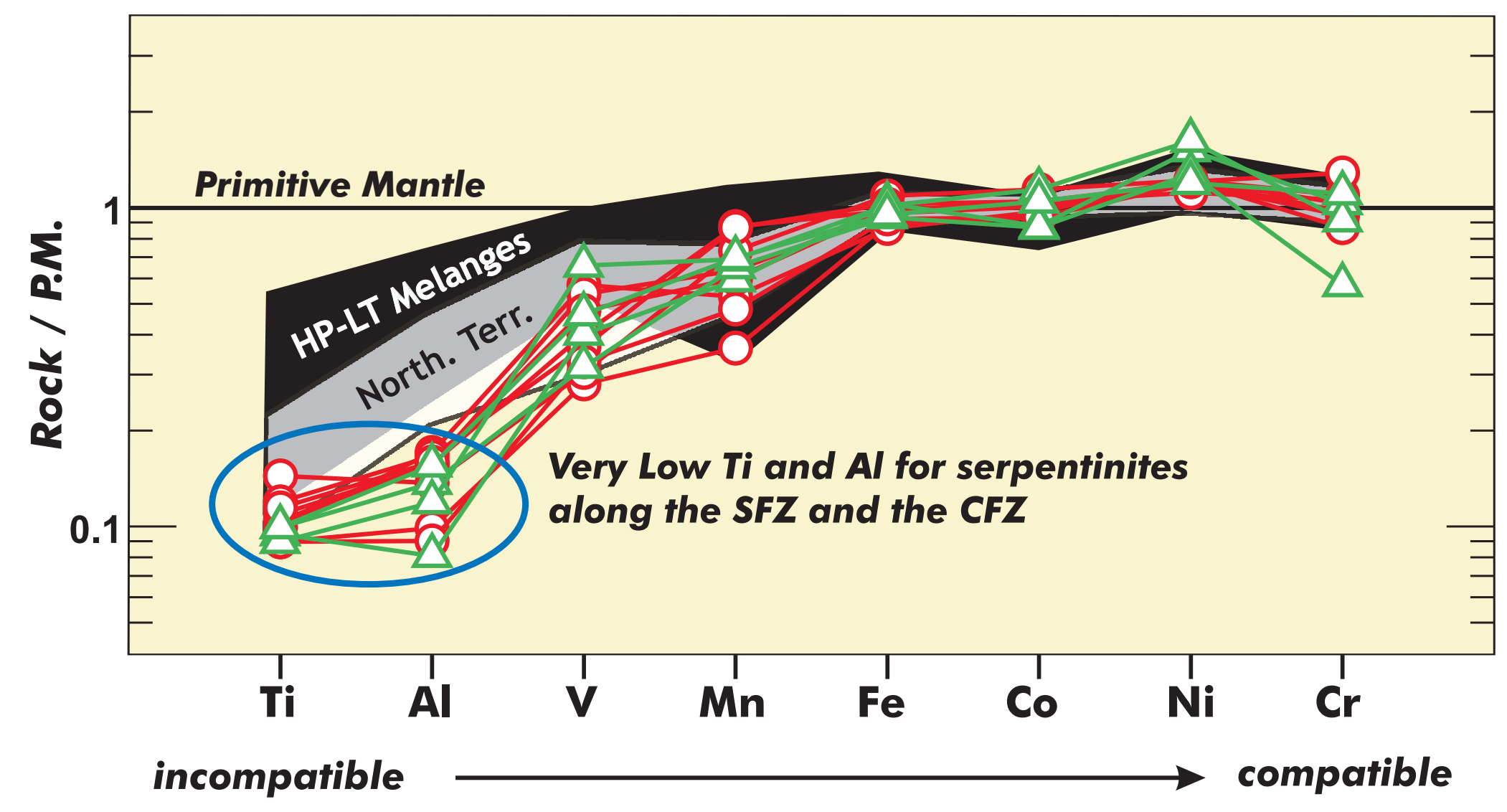
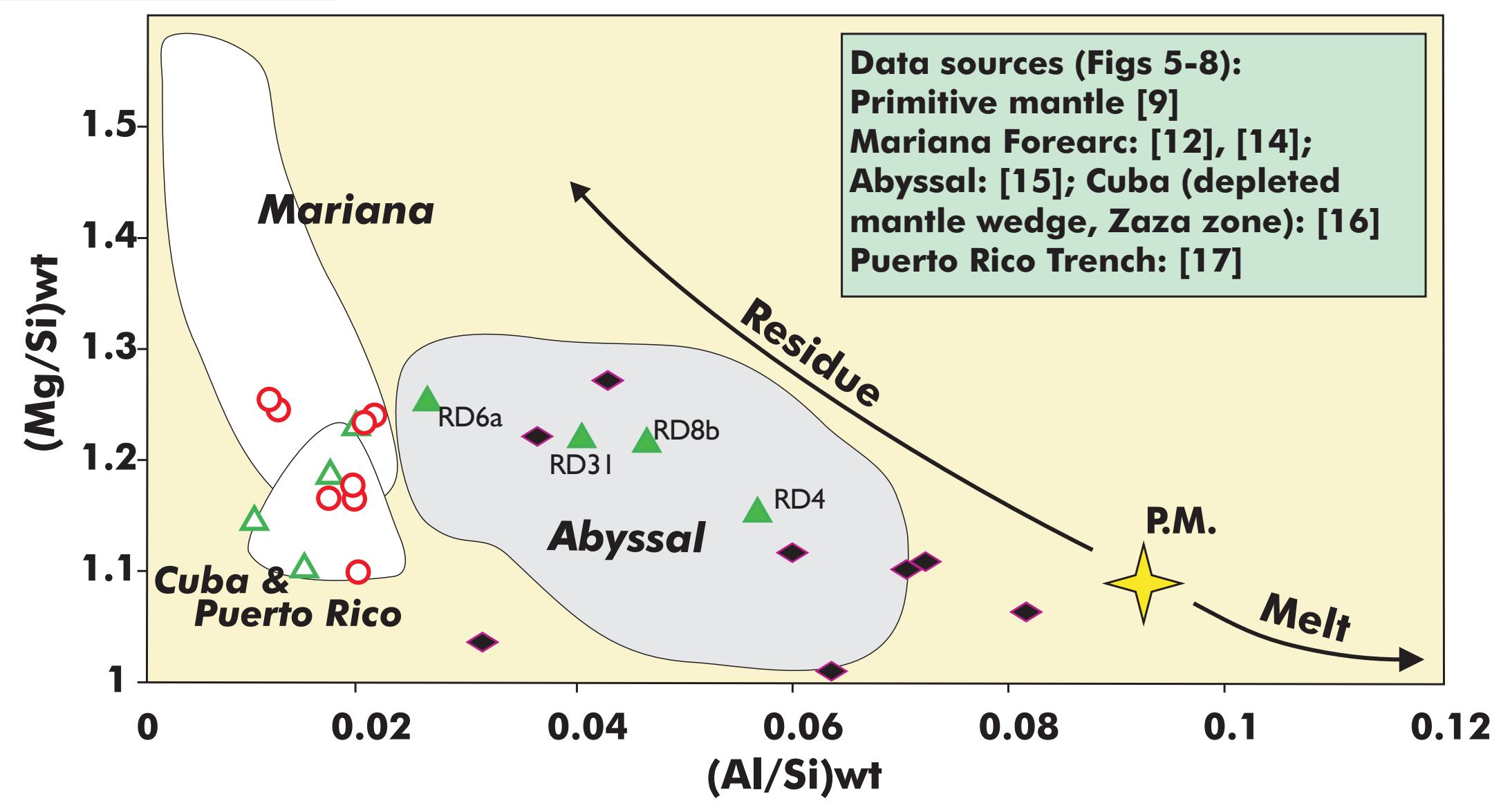


Fig. 8 (mod. from [16])



Data sources (Figs 5-8):
Primitive mantle [9]
Mariana Forearc: [12], [14];
Abyssal: [15]; Cuba (depleted mantle wedge, Zaza zone): [16]
Puerto Rico Trench: [17]

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