# The stability of calcite and aragonite in sediments overlying zones of basement fluid upwelling in the eastern flank of the Juan de Fuca ridge

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Heat flow measurements and sediment porewater composition data collected on the Eastern flank of the Juan de Fuca ridge during numerous cruises have evidenced the extend and the features of the low temperature fluid circulation in ridge flanks, with the aim of quantifying the contribution of this circulation to heat and mass fluxes between the ocean and the oceanic crust. One of the questions is to know how basement fluid may react with the sediment, with the consequent modification of the composition of basement fluids discharging to the seafloor.

The Retroflux expedition (September 2000) has mapped fluid discharge zones associated with basaltic outcrops and seamounts using heat flow measurements and coring. Ninety three cores (up to 7 meters in length) were collected during this expedition. Porewaters were analyzed on board for chlorinity, Ca, Mg, pH, alkalinity, and nutrients and on shore for trace elements. In upwelling areas, porewaters display a rapid Mg depletion and Ca enrichment with depth consistent with a fluid in basement that has reacted with basalt at low temperatures. These upwelling fluids have an alkalinity that is lower than that of seawater. In contrast, porewaters from cores collected outside zones of fluid discharge have alkalinities that increase with depth resulting from the oxidation of organic matter and the reduction of sulfate during diagenesis. Thus a variety of alkalinity depth profiles exists reflecting the competition between alkalinity production from diagenetic reactions and the transport of an alkalinity-depleted basement fluid. pH variations reflect sediment heterogeneities (local chemical reactions?) that persist even in zones of rapid fluid upwelling. Thermodynamic calculations show that equilibrium with aragonite is achieved for cores without diagenesis or flow, at in situ T and P, which excludes any sampling bias. They also reveal a variety of cases for equilibrium and/or supersaturation with respect to either aragonite or calcite, depending on the increase in alkalinity, the rate of fluid upwelling and the degree of alteration of discharging basement fluids with respect to normal seawater.

# Melt segregation and melt – mantle interaction in a supra-subduction zone context: An example from the Khoy ophiolite, NW Iran

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## Introduction

Petrographic and geochemical studies of residual mantle exposures in supra-subduction zone environment provide important information on partial melting, melt segregation and melt – mantle interaction processes in the oceanic mantle lithosphere. Ultramafic tectonites comprise dominantly lherzolites and cpx-harzburgites in Khoy ophiolites.

## Discussion of results

These peridotites can be distinguished into three groups: 1- Peridotite type-(I) samples contain Al – rich spinels (Cr# of 0.16 – 0.26, Mg# of 0.75 – 0.68 and $Tio_2$ = 0.01 - 0.12 Wt %) with generally smooth LREE – depleted and fairly flat MREE – HREE profiles. 2 - Peridotite type-(Π) samples contain Cr – rich spinels (Cr# of 0.31 – 0.66, Mg# of 0.66 – 0.89 and $Tio_2$ = 0.00 to 0.06 Wt %) with LREE – depleted and positive slopes MREE – HREE profiles. 3 - Particular peridotite samples contain Cr – rich spinels (Cr# of 0.45 – 0.88, Mg# of 0.63 – 0.86 and $Tio_2$ = 0.13 to 1.03 Wt %) with U – shaped REE patterns indicative of interaction between LREE – depleted mantle peridotites and LREE – enriched extracted melt.

## Conclusions

The results illustrate that the peridotite type-(I) samples resemble fertile abyssal peridotites, which has probably originated as the residue from less than 15% partial melting and MORB magma extraction in a slow – spreading back – arc basin centre. Peridotite type-(Π) samples represent depleted abyssal or supra – subduction zone peridotites, which has experienced more than 15% partial melting from segregation of IAT or transitional IAT-MORB magmas. Peridotite type-(Π) samples were subsequently modified to particular peridotite samples by interacting with divers types of arc magmas in a supra-subduction zone setting.

## References

Pearce J.P., Barker P.F., Edwards S.J., Parkinson I.J., Leat P.T., (2000), *Contributions to Mineralogy and Petrology* **139**, 36-53.

Gruau G., Bernard-Griffiths J., Lecuyer C., (1998), *Geochim. Cosmochim Acta* **62**, 3545-3560.