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# SEISMIC ANISOTROPY IN THE SOUTH WESTERN PACIFIC REGION FROM SHEAR-WAVE SPLITTING

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## I.INTRODUCTION

Seismic anisotropy is of considerable interest to the Earth science community, since it allows constraining in-situ deformation within the Earth using surface observations (e.g. Savage 1999). One of these effects is to modify the polarization of P-waves, another is to split shear-waves into multiple, orthogonally polarized waves. We study shear-wave splitting of SKS and SKKS phases which is facilitated by the known initial polarization (radial) as they leave the core. We perform shear-wave splitting measurements to determine seismic anisotropy in the upper mantle under the remote and still not well-understood South Western Pacific Region, more precisely the New Hebrides subduction zone.

This study is the first comprehensive shear-wave splitting study of the New Hebrides subduction zone.

If shear waves propagate through an anisotropic layer, they split into two S-waves polarized in two perpendicular orientations, propagating at different speeds (fast S-wave and slow S-wave). To determine anisotropy, two parameters need to be calculated: polarization direction of the fast shear wave (Φ) and the time delay (δt) between the fast and slow splitted waves (e.g. Silver and Chan 1991). Time delay depends on the strength of anisotropy and the thickness of anisotropic layer.

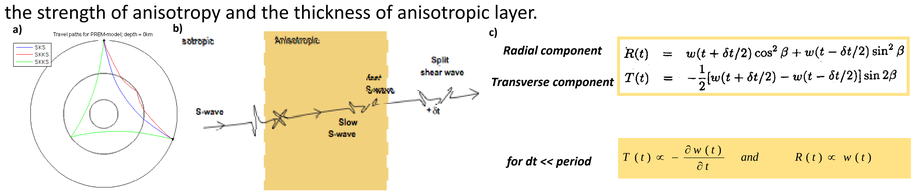



Figure: a) SKS and SKKS phases in the interior of the Earth; b) Splitting of a shear wave propagating through an anisotropic medium; c) Radial and transverse components of the split SKS waves

## II. GEODYNAMICS OF STUDY AREA

The subduction is located between New Caledonia and the islands of the New Hebrides where the Australian plate is subducting eastward under the Pacific plate. This region exhibits complicated geodynamical features, resulting from its evolution during the past 100 My. According to Schellart et al. (2006) model, the New Hebrides subduction zone initiated in the last 10 Ma, rolling back to the west with clockwise asymmetric rotation and opening the wedge-shaped North Fiji Basin.

The subduction may have been accompanied by lateral flow of mantle material around the lateral slab edge towards the mantle wedge side. On the mantle wedge side, geochemical studies based on lead isotopes (e.g., Heyworth et al., 2011) suggest a significant trench-parallel flow. The young, fast and deep subduction zone with the unusual asymmetric rotation may create unique structures in the upper mantle.

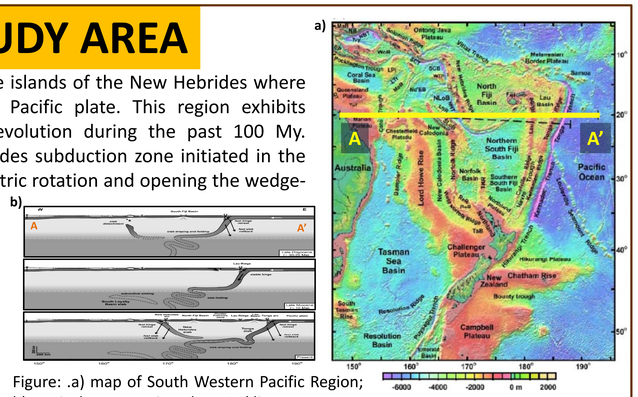



Figure: .a) map of South Western Pacific Region; b) vertical cross section along AA' line

Schellart et al (2006)

## III.DATA AND PROCESSING

We used data from Geoscope and GSN stations, and from the local Cavascope network (Pillet et al., 2008). Teleseismic events located at distances in the range of 85° to 140° and of magnitude greater than 6.0 have been recorded at 8 stations. 174 events have been selected in order to get the largest and best possible data quality. We obtained 29 good and 35 fair splitting measurements and 93 good and fair Null measurements.

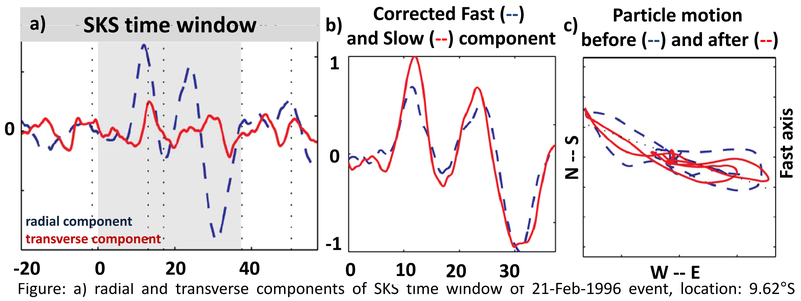



Figure: a) radial and transverse components of SKS time window of 21-Feb-1996 event, location: 9.62°S 79.57°W, depth: 33km, Mw = 7.5, station: NOUC; b) corrected fast and slow components; c) particle motion before and after the correction

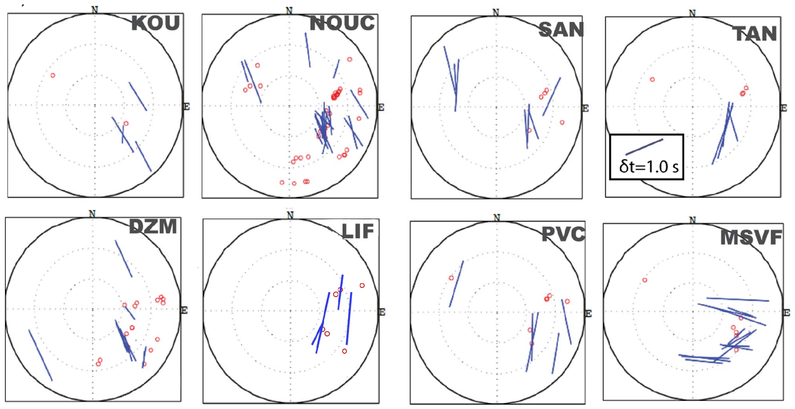
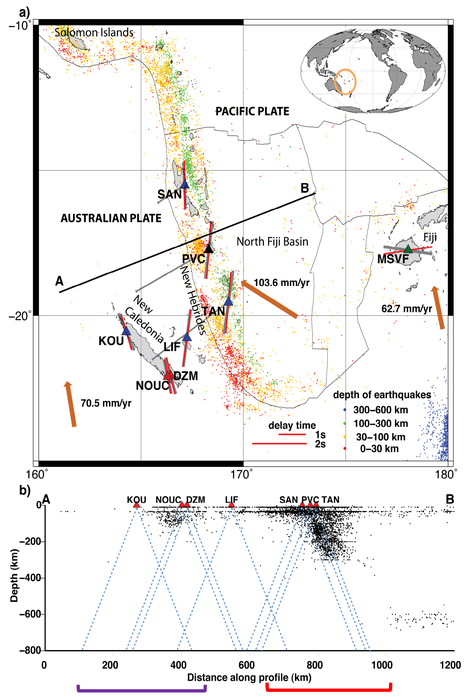


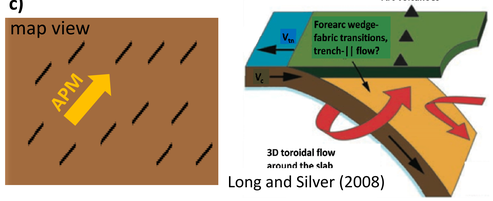

Figure: Lower hemispheres under the stations showing individual splitting measurements indicating backazimuthal direction (position of the bar), splitting orientation (orientation of the bar) and delay time (length of the bar).

## IV.RESULTS AND CONCLUSIONS




Anisotropy from the upper mantle and/or transition zone

Contribution of slab and mantle wedge more and more important




Long and Silver (2008)

Figure: a) map of the New Hebrides Trench with SKS splitting results, AB line shows the location of trench-normal cross section; b) cross section of AB line with seismicity between 2000-2011; c) potential models

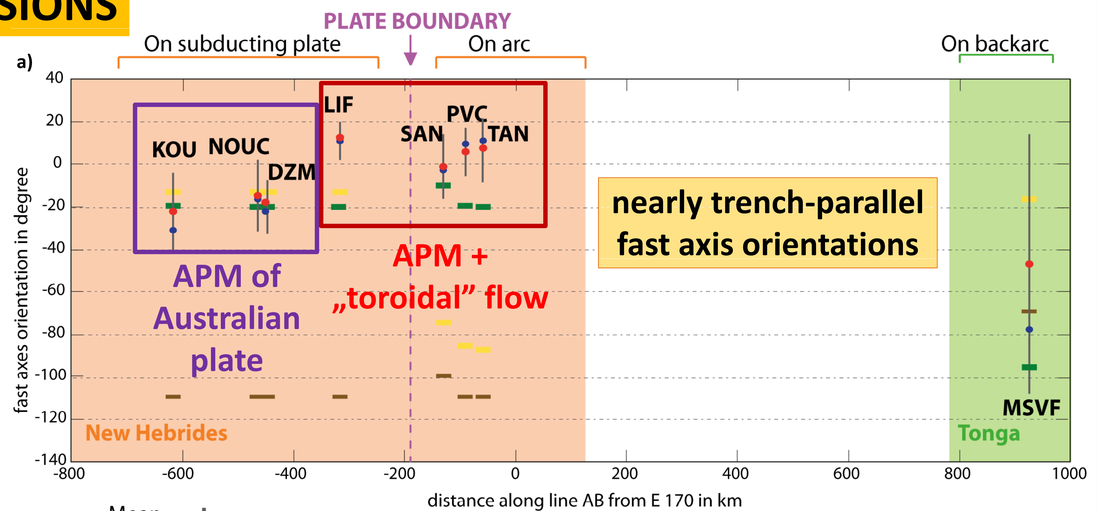



Figure: a) fast axis orientation of anisotropy under New Hebrides Trench stations (KOU, NOUC, DZM, TAN, PVC, SAN) and Tonga station (MSVF) in function of distance along the trench-normal AB line (see map); b) splitting delay times under each station in fuction of distance along AB line

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