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# Increase in intermediate seismicity rate below the Colombian Andes visualised and interpreted through combined local seismic tomograpy and hypocentral profiles: Eje Cafetero region and Bucaramanga seismic nest

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## INTRODUCTION

The convergence of Caribbean plate to the north of South America which there is in an oblique collision with the northwest corner of the continent has been the result of the accommodation of Nazca plate with this sector of the continent after a change in the expansion rate of Galapagos triple junction in the oriental Pacific from Pliocene. The Costa Rica - Panama - Choco Block (CRPCB) collided and emerged when Caribbean plate was assembled with North America and South America plates. As a result of the above-mentioned Nazca plate converges between Eastern Panama and West Colombia as we observe it today. Recently the paper of the change angle of plane subduted has direct relation to seismicity increment in a region as for example Oleskevich et al. (1999), and Gutscher & Peacock (2003). The asperity in siesmicity increases the hazard over great population region like Eje Cafetero in western and Santander in north eastern Colombia respectability. With the application hipocentral profiles and Local Seismic Tomography as visualization the possible geometric configuration of the area of Nazca plate subduction between 3,5° - 7,5° N for explain this seismological phenomenon.

## APPLIED ELEMENTS AND THEORETICAL MODELS

The application of the Local Seismic Tomography (LST) was made by Vargas (2004) for the Colombian territory and hipocentral profiles as result of instrumental registration of the Red Sismológica Nacional de Colombia (RSNC) for the period 1993 - 2001, with a database of 7819 events (Fig. 1), (Ingeominas, 2001). The hipocentral profiles a width of corridor of approximately 1,5° or 150 Km and the profiles generated by LST of Vargas (2004). LST and hipocentral profiles merge make an interpretation of the possible geometric configuration of the mantle and low lithosphere of Colombia sectors.

## RESULTS AND DISCUSSION

In figs. 2 A between the 6° N - 7, 5° N the flat subduction is observed and previously corroborated by Monsalve (1998) and Gutscher et al. (2000). Between 73° W - 74, 5° W and same latitudes to 90 - 200 km depth showing Bucaramanga Nest. For it Chicangana and Vargas (2004), interprets how part of the old subducted slab of Farallon plate that it was delaminated partially for the sub – lithosphere collision with Nazca slab in Neogene times. At Late Neogene at this region the delamination process increased by the interaction between the CRPCB collision and the anticlockwise rotation of South American plate. The LST showing between the 73° W - 73, 5° W and to 80 - 120 km deep a region of high percentage of Vp indicates high rigidity in this part of sub lithosphere environment (Figs. 2 A & B). With hipocentral profiles it´s interpreted how rigid part of old Farallon slab. Between the 4, 5° N - 6° N as also showing two areas of seismicity strong under Eje Cafetero region (Fig. 2 B), where present increases intermediate seismicity rates due to angle change in Nazca slab so between 76, 5° W - 77° W to 60 - 120 km deep while between 74° W - 74, 5° W Nazca slab to 100 - 200 km deep, also increase seismicity rates. In the previous region it is interpreted for the first case how seismogenic zones characteristic of intraslab intermediate seismicity (Peacock , 2001; Hacker et al., 2003; McNeill et al., 2004), where angle change as due to asperity sub continental presence. In second case, the seismicity increase is due to the interaction of the old delaminated Farallon slab in colision with South American sub lithosphere at eastern at same latitudes under Cordillera Oriental of Colombia Andes (Chicangana & Vargas, 2004).

## CONCLUSION

With this work as inferred to the geometry of the subduction Nazca Slab between 4°N – 7,5° N and 74° W – 77° W under the western Colombian Andes applying the combination of techniques how local seismic tomography and the hipocentral profiles. This exercise will serve for future studies of same type for seismogenic sources in subduction and help to visualization and understanding of these sub lithospheric zones where increases of intermediate seismicity.

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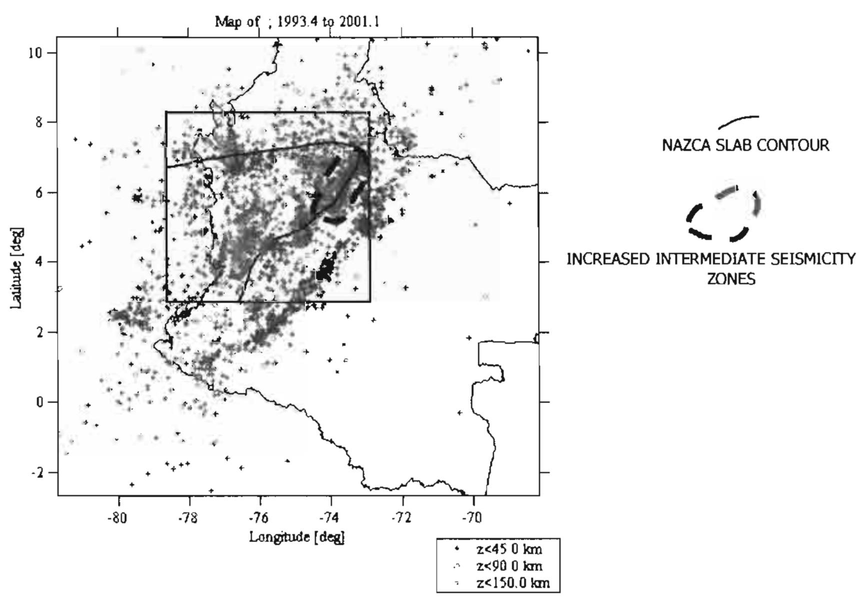


**Fig. 1**. Map that shows instrumental Registration of the RSNC for the period 1993-2001 (Ingeominas, 2001), In frame showing the area that defines this work, together with the Nazca slab contour and rates increase intermediate seismicity zones.

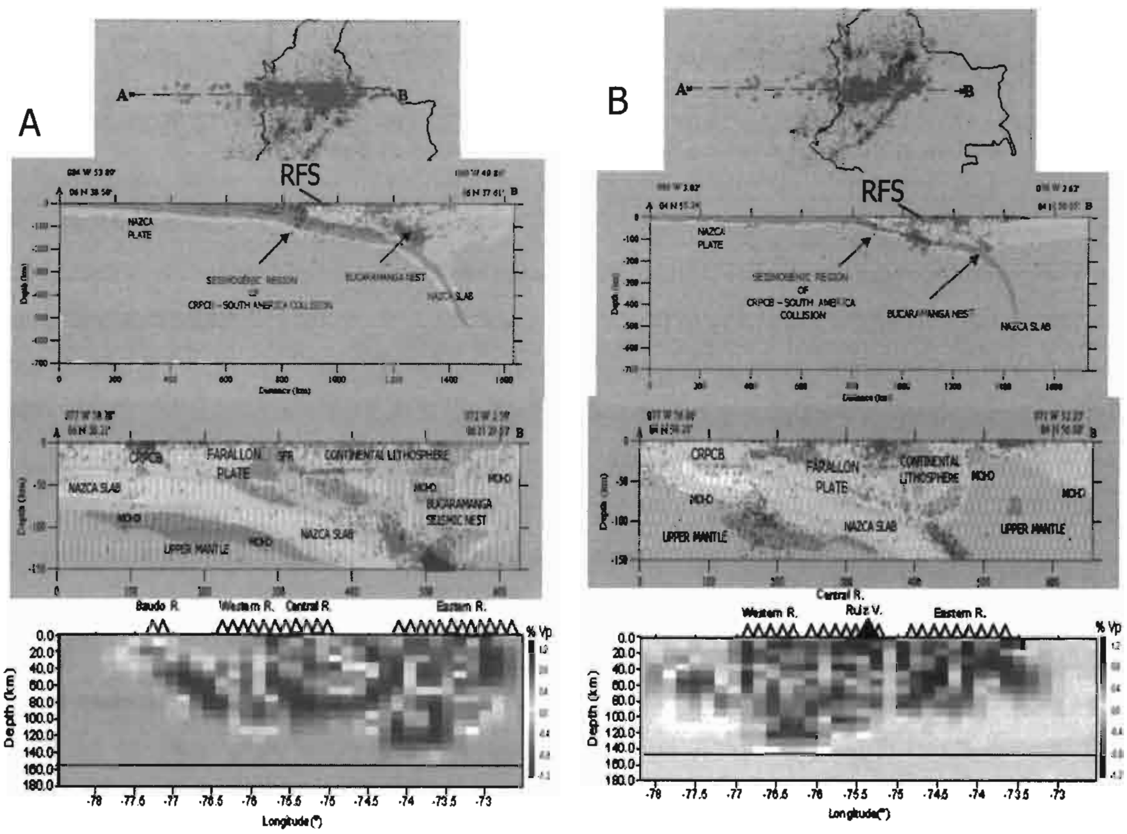


**Fig. 2.** A, Above, hypothetical general cartoon of subduction Nazca plate between 6° N - 7,5° N together with detailed interpretation of combined profile hipocentral and local seismic tomographic that observed below. B, same as A, but between 4° N - 6° N. The hipocentral profiles embraces longitudes between 72° W – 77, 5°W and 150 km maximum deep for both cases below.