NEOTECTONICS OF THE ANDEAN FOREDEEP BASIN (MARANON BASIN) IN NORTHEASTERN PERU

Jean François DUMONT * and Fredy GARCIA **

* Mission ORSTOM Apartado 18-1209, Lima, Peru

** Mission ORSTOM and IGP, Ap. 3747, Lima, Peru

Abstract

Neotectonics of the Marañon basin has been studied using fluvial pattern data. Migration of subsiding areas has been identified by successives avulsions of the Ucayali River. These data with others from the basin borders allow to define the neotectonic evolution of the subandean/craton margin.

Résumé

La néotectonique du bassin du Marañon a été étudiée à partir des structures fluviales. La migration des zones de subsidence a été identifiée par les captures successives de l'Ucayali. Ces données, avec d'autres provenant des bordures du bassin permettent de préciser l'évolution néotectonique de la marge subandin/craton.

Key words : fluvial pattern, neotectonics, subsidence, Amazonian basin, Subandean zone, Brasilian craton, Peru.

Introduction

The Marañon foredeep basin is a transition zone between the extensive cratonic Brazilian shield, moving toward the west, and the andean foothills pushed eastward by the subducting Nazca plate. Field and remote sensing studies (SLAR, Lansat and SPOT imagery) of fluvial pattern at various stages of activity and abandonment provide a key to investigate surface deformation of the Marañon Basin.

Geological setting

The Marañon Basin is a large morphological depression where all the rivers running down from the Andes between 2º and 14º south merge to form the Amazon River. During the Cenozoic the subsiding center of the basin migrated eastward as a result of the folding and thrusting of the subandean margin (Pardo 1982). 5000m of post Jurassic sediments accumulated in the central part, and Tertiary deposits lap eastward onto the Iquitos geanticline (Sanz 1974).

The Ucamara depression

Villarejo ([1943],1988) called "Ucamara depression" the central part of the Marañon Basin, a 25000 square km swampy area, devoid of any elevation between the Ucayali and the Ucayali rivers (fig.1). These rivers carry "white" silty water running down from the Andes. The river divide areas are drained and periodically flooded by "black" waters of local precipitation origin. The main black water rivers, follow fossilized meander belt of the same pattern than the present Ucayali River. They are interpreted as former reach of the Ucayali River which have been abandonned after an avulsion of the main river. Three successive avulsions of the Ucayali River, cumulating a 100km lateral migration toward the Southeast have been identified from these fossilised fluvial patterns.

The Tapiche area in the southeastern part of the Marañon Basin was a non flooded area covered by upland type forest (bosque de altura; Stiglish 1907). According to historical data from direct witnesses, the area began to subside during the twenties. A 750 square km area called Punga swamp is presently 2m below low water level, which represent about 4m of subsidence in 60 years. The phenomenon is testified by remains of dead trees of the former upland forest conserved in life position, and presently below permanent flooding. Simultaneously, southeastward avulsion of the Tapiche river occured. Presently the river to cross through the Punga swamp, the white waters of the Tapiche River being limited from the black waters of the permanent swamp by narrrows levees, less than 5m wide. Lower stream of the Punga, the Tapiche river follow an older river valley caracterised by extensive point bar type river banks and oxbows.

Andean crust and Brasilian shield relationship

The Ucamara depression is bordered southward by Contaya and Moa Sierras, which belongs to the subandean lowland

(Dumont et al 1990). The Sierra de Moa is uplifted and its northeastern border overthrusted over the Acre basin deposits along the Tapiche fault zone (fig.1). Neotectonic activity of the Tapiche fault area includes strong late Tertiary fold and fault episodes, and continuing uplift of the Sierra de Moa during Quaternary. Teleseismic data (Assumpçao and Suarez 1988) suggest that the compressional regime is yet efective between the two blocks, and concern both the Andean foreland and the Brasilian craton.

Combination of compressional linkage in central Peru, between the Subandean lowland and the Bresilian craton, and active subsidence in the Ucamara depression, suggests a slight anticlockwise rotation of the southern part of the Iquitos geanticline. This rotation is responsible for the breaking of the Iquitos geanticline in two parts, in the area where the Marañon and Ucayali rivers merge and cross the Iquitos block. In this area, normal faulting compatible with this rotatin has been identified (Dumont et al,1988).

Conclusion

Fluvial pattern studies give valuable data on the neotectonic evolution of the Marañon Basin, and are coherent with other types of data. Tectonically induced subsidence, probably controlled by basement faults, generate sudden avulsion of the main rivers. This result is in contradiction with the Räsänen et al's (1987) model of steady lateral migration of rivers as a result of subandean tectonic, as well in the Subandean areas (Dumont 1989) than in the Marañon Basin. The effect of west Amazonian neotectonics on fluvial changes and ecological evolution make pluridisciplinary studies of these regions of a very high interest (Salo et al 1986; Dumont et al 1990).

Acknowledgments: This work was supported by two agreements: ORSTOM/IGP and ORSTOM/IIAP. This is a contribution to PICG project 279 "Terranes in Latinoamerica".

References

ASSUMPÇAO M. and SUAREZ G., 1988. Source mechanisms of moderate size earthquakes and stress orientation in mid-plate South America. Geophysical Journal, 92:253-267.

DUMONT J.F., 1989. Morphostructural units of the Peruvian Amazonia as related to Subandean tectonics and fluvial dynamics. 28th International Geological Congress, Washington, vol.1:423-424.

DUMONT J.F., LAMOTTE S. and FOURNIER M.,1988. Neotectonica del Arco de Iquitos (Jenaro Herrera, Peru). Bol. Soc. Geol. Peru, 77:7-17.

DUMONT,J.F.,LAMOTTE,S., and KAHN,F.,1990. Wetland and upland forest ecosysems in Peruvian Amazonia : plant species diversity in the light of some geological and botanical evidences. Forest Ecology and Management, (under press).

PARDO A, 1982. Caracteristicas estructurales de la faja subandina del Norte del Peru. Simposio "Exploracion petrolera en las cuencas subandinas de Venezuela, Colombia, Ecuador y Peru", Caracas.

RASANEN,M.E.,SALO,J.S.,and KALIOLA,R.J.,1987. Fluvial perturbance in the western Amazon river basin: Regulation by long term sub-Andean tectonics. Science, 238: 1398-1401.

SALO,J.,KALLIOLA,R., HAKKINEN,I., MAKKINEN,I., NIEMELA,P., PUHAKKA,M., and COLEY,D.,1986. River dynamics and the diversity of Amazon lowlands forest. Nature, v.322:254-258.

SANZ V.,P.,1974. Geologia preliminar del area Tigre-Corrientes en el Oriente Peruano. Bol. Soc. Geol. Peru, 44:106-127.

STIGLISH G., 1907. Ultimas exploraciones ordenadas por la Junta de vias fluviales a los rios Ucayali, Madre de Dios, Paucartambo y Urubamba. Oficina tipografica de "La Opinion Nacional",461pp.

VILLAREJO A.,1988,[1943]. Asi es la Selva. Centro de Estudio Teologico de la Amazonia, Iquitos, 329pp.

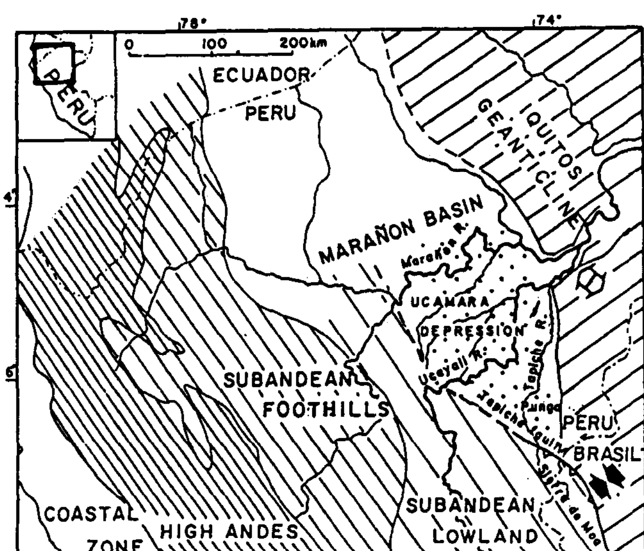

Fig. 1 : Structural scheme of northern Peru. Large arrows show the stress regime deducted from neotectonic data (faults) from the Tapiche fault zone (black arrows) and from the Jenaro Herrera area (white arrows).