CENOZOIC TECTONICS AND PALEOMAGNETISM WEST OF ROMERAL FAULT ZONE, COLOMBIAN ANDES

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RESUMEN: Se reportan resultados paleomagneticos en intrusivos subvolcanicos del Cenozoico Tardio y en sedimentos asociados localizados ambos a lo largo de la zona de falla de Romeral. Los cuerpos intrusivos muestran dos tipos de rotacion, al rededor de ejes horizontales perpendiculares a la falla y al rededor de ejes verticales. Los sedimentos sugieren leves rotaciones al rededor de ejes verticales. Ambos grupos de rocas han sido afectados por movimientos laterales tanto sinistrales como dextrales aunque este ultimo ha dominado en el tiempo.

KEY WORDS: Paleomagnetism, Late Cenozoic, Andes, Colombia, Romeral, tectonic rotation.

INTRODUCTION

The Romeral fault zone (Grosse, 1926) is one of the major fault zones of the northern Andes. It bounds the Cauca depression on the east for hundreds of kilometers between the Central and Western Cordillera of Colombia. Long thought to be a right-lateral fault zone (Campbell, 1974), this fault has been shown by seismic studies (Hutchings et al, 1981) to have left-lateral recent movements. A paleomagnetic study of late Cenozoic (approximately 8 Ma) silicic hypabyssal intrusives revealed an interesting but enigmatic dispersal pattern of the paleomagnetic vectors into vertical planes (MacDonald, 1980) of N40W trend. The present study extends the paleomagnetic sampling both geographically, to approximately 100 km further south, and geologically to younger stratified units, in the Irra pull-apart basin west of Manizales.

PALEOMAGNETIC RESULTS AND TECTONIC SIGNIFICANCE

1. Late Cenozoic intrusive rocks. Paleomagnetic studies of approximately 14 sites from the region south of the earlier study show dispersal patterns similar to those obtained previously, except that the trend is N-S instead of N40W. Eigenvalue analysis shows the planes of dispersal to be nearly vertical. These trends are recognized now as being parallel to the trend of the Romeral fault system adjacent to the east. Dispersal within individual bodies is relatively minor, but large relative rotations about horizontal axes have occurred between bodies. These rotation axes are perpendicular to the Romeral fault zone.Two episodes of rotation can be inferred from these patterns. An earlier period of non-coherent rotations of individual bodies about horizontal axes of E-W trend was followed by a period of rotations in which both fault zone and adjacent rocks were rotated, presumably as vertical panels, about vertical axes during bending or kinking of the fault zone.

2. Late Cenozoic strata of the Irra basin. Sediments of the Irra basin near the south limit of the sampled hypabyssal rocks are latest Cenozoic, approximately coeval with the Combia Formation. These strata are folded and thrust with NE structural trends. Sediments, volcaniclastic rocks, and ashflows have paleomagnetic declinations dominantly N10E to N20E. For 16 sites investigated, normal and reverse polarities are approximately equal suggesting primary remanence is preserved. The clockwise sense of

rotation is consistent with right-lateral slip on the marginal faults of the Irra basin. However, compressional patterns are consistent with left-lateral shear across this right-stepping offset.

CONCLUSIONS

These paleomagnetic results indicate multi-modal rotational histories for both the sedimentary and intrusive rocks of the Cauca depression in this region of the Romeral fault. Among the most important conclusions are the following:

1. The rotation of the massive intrusives about horizontal axes perpendicular to the Romeral fault system suggests a kind of mechanical behavior in fault zones not observed previously. It should be looked for in other strike-slip fault zones.

2. The structural evidence for the Irra basin indicate reversals of the sense of slip along the Romeral system. The pull-apart formed in right-lateral shear, and the folding and thrusting in left lateral shear. The timing of the paleomagnetically indicated rotations is tentatively placed as pre-folding.

REFERENCES

Campbell, C.J., 1974, Colombian Andes, in A.M. Spencer, editor, Mesozoic-Cenozoic orogenic belts: Geol. Soc. London, Special Publication 4, p. 705-724.
Grosse, E., 1926, Estudio Geologico del Terciario Carbonifero de Antioquia: D. Reimer, Berlin, 361 p.
Hutchings, L., Turcotte, T., McBride, J., and Ochoa, H., 1981, Microseismicity along and near the Dolores shear zone in Antioquia, Colombia: Revista, Centro Interamericano de Fotointerpretacion, Bogota, v. 6, p. 243-256.
MacDonald, W.D., 1980, Anomalous paleomagnetic directions in Late Tertiary andesitic intrusions of the Cauca depression, Colombian Andes: Tectonophysics, v. 68, p. 339-348.