# PALAEOMAGNETISM OF LATE PRECAMBRIAN SCHISTS FROM TAXCO VIEJO, GUERRERO: PROBLEMS IN CLARIFYING THEIR DIRECTIONS OF REMANENT MAGNETIZATIONS

J. URRUTIA-FUCUGAUCHI*

**RESUMEN**

Resultados preliminares de un estudio paleomagnético de esquistos del Precámbrico Tardío del área de Taxco Viejo, Estado de Guerrero, indican que la magnetización remanente de los mismos es de múltiples fases. Desmagnetización por campos magnéticos alternos decrecientes muestra la presencia de componentes magnéticos inestables de baja coercitividad. No es posible separar los diferentes componentes magnéticos.

**ABSTRACT**

A reconnaissance palaeomagnetic investigation of schists from the Late Precambrian Esquisto Taxco, reveals that their remanent magnetization is of multiphase nature. Alternating field demagnetization shows the presence of unstable components of low coercitivity spectra. It is concluded that any palaeomagnetic significance can be attached to the present results.

## 1. INTRODUCTION

The area around Taxco villaje, Guerrero State, has long been studies at is was one of the most important mining districts of the New Spain (Mexico); mining operations (notably silver) were initiated before the arrival of the Spanish conquerors, so, the district has been worked for at least 460 years. This study was undertaken mainly to establish wheter schists of the Esquisto Taxco (Late Precambrian Palaeozoic) are suitable for further palaeomagnetic investigation.

*Laboratorio de Paleomagnetismo y Geofísica Nuclear, Instituto de Geofísica, UNAM.

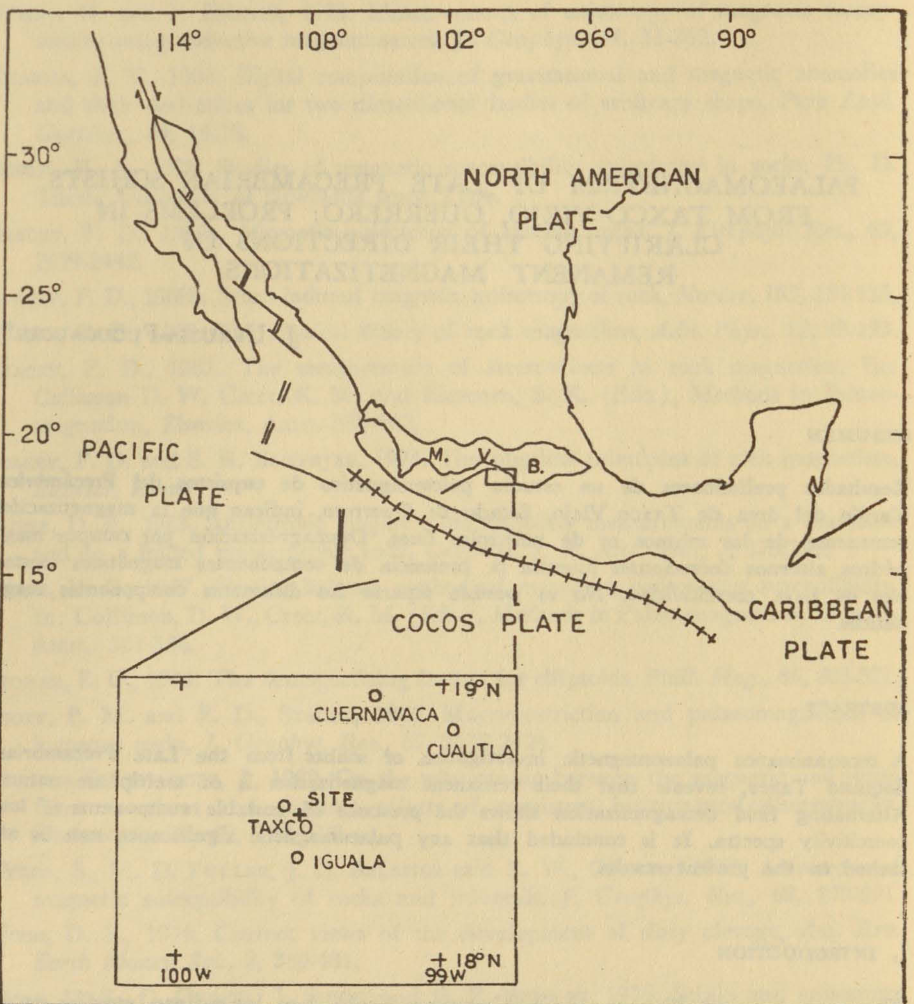


FIG. 1. Schematic map showing location of sampling sites for palaeomagnetic study.

The schists were studied by Fries (1956) and correspond to sericite schists formed from rhyolitic tuffs. These generally present a dark brown colour due to oxidation, being light brown to green in fresh cuts. De Cserna *et al.* (1974) reported a Pb-a date determination using zircon concentrates of 1020 ± 110 Myr, i.e., Late Precambrian.

## 2. METHODS AND RESULTS

The schists in the sampling area (Figure 1) present a greenish grey color in fresch cuts, and a light-to- dark brown color in weathered surfaces. Samples were strongly foliated although it was difficult to determine any preferred orientation. Petrographic analyses indicate that the schists contain quarts, sanidine, biotite, and small amounts of zircon and apatite; secondary minerals are sericite, chlorite and geothite. Sampling was limited to ten hand samples orientated with magnetic compass.

In the laboratory one core was drilled from each sample, and one or two specimens of 2.5 cm diameter and height were sliced from each core. The direction and intensity of natural remanent magnetization (NRM) were measured with a Digico spinner magnetometer (Molyneux, 1971). The initial directions were divergent from both the present Earth's magnetic field and dipolar direction (Figure 2). The intensities varied between 0.4 and 0.7 $.10^{-6}$ emu/cc ($10^{-3}$ A/m), except for two samples with intensities between 37.5 and $40.10^{-6}$ emu/cc ($10^{-3}$ A/m). The next step was to investigate the vectorial composition of the remanences, and to test the directional stability. Pilot specimens were submitted to alternating field (AF) demagnetization by using an electronically controlled AF demagnetizer (de Sa and Widdowson, 1974). The results revealed large angular movements with the treatment, and an effort was made to detect any systematic directional changes (Figure 3a, b). A stable single-phase magnetization should give small random angular movements (measurement errors) about a mean direction at successive measurements, this until the intensity decays into the instrumental noise level. Consistent movements wouldindicate that the magnetization contains more than one phase. Depending on the coercivity spectra of the individual phases, it may be possible to isolate them (Urrutia-Fucugauchi, 1979). In the present case, the results (Figure 3a, b) indicate the presence of multiphase magnetizations with relatively low coercivity spectra (i.e. less than 300 Oe), indicating poor directional stability. Unstable remanent magnetizations in igneous rocks (thermoremanent magnetizations, TRM) reside in multidomain grains, whereas, stable TRMs reside in single-domain grains or pseudo-single-domain grains (Evans and McElhinny, 1969; Dunlop *et al.*, 1973). For single-domain grains the relaxation time is related to the coercivity spectrum, that is to the maximum alternating field the grains can withstand (McElhinny, 1973). Experimental work by Evans and McElhinny (1969) indicates that single-domain grains present large coercive forces whereas multidomain grains present low coercive forces (less than 800 Oe). It appears from here that the remanences of these roks reside in multidomain grains. Since the rocks were affected by metamorphism, there is the possibility that the remanences may be of chemical origin (i.e. associated with formation of new magnetic material). From the present results it seems likely that the remanence is the vectororial sum of several components, perhaps a chemical remanent magnetization (CRM), a T-CRM, a C-TRM, and even viscous remanent magnetizations (VRM).

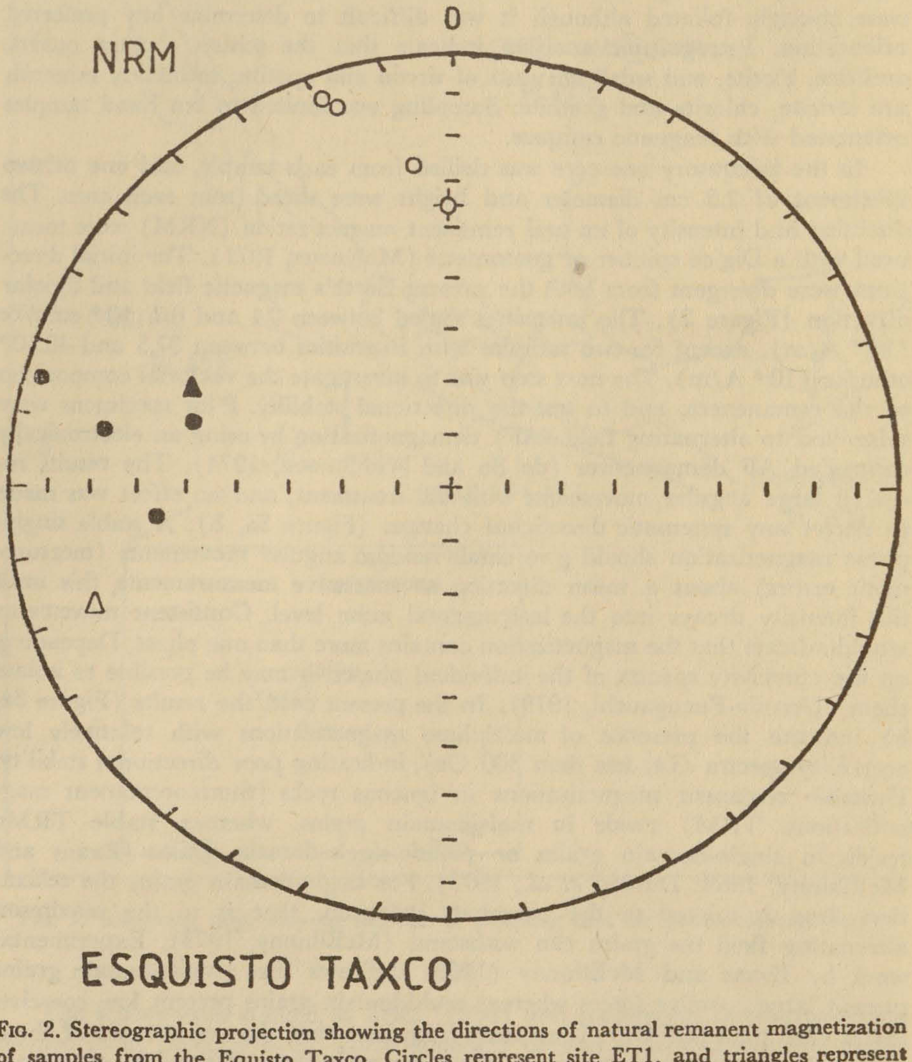


FIG. 2. Stereographic projection showing the directions of natural remanent magnetization of samples from the Equisto Taxco. Circles represent site ET1, and triangles represent site ET2. Closed symbols indicate positive inclinations, and open symbols indicate negative inclinations.

Mean directions of magnetization and corresponding mean pole positions were calculated from all results (Table 1). Because of the unstable directional behaviour during AF demagnetization, which did not permit to identify the magnetic phase (magnetic carriers and time of remanence acquisition), and the relatively large scatter in directions (i.e. $\alpha_{95} = 30.9°$) it is concluded that any significance can be attached to the present results.

TABLE 1

SUMMARY OF PALAEOMAGNETIC RESULTS OF THE SCHISTS OF THE ESQUISTO TAXCO

| NRM (referred to the present horizontal pole position | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Site | N | E | J | DEC | INC | k | $\alpha_{95}$ | $P_{lat}$ | $P_{long}$ | $A_{95}$ |
| ET1 | 4 | 8 | 2.68 | 313.9 | 5.3 | 4. | 33.9 | 41.4 | 157.8 | 29.7 |
| ET2 | 2 | 2 | 0.54 | 269.3 | 11.1 | — | — | 2.8 | 176.5 | — |
| mean | 6 | 10 | 1.94 | 204.8 | 6.9 | 3. | 30.9 | 34.0 | 161.6 | 26.7 |

BIBLIOGRAPHY

DESA, A. and J. W. WIDDOWSON, 1974. A. digitally controlled AF demagnetizer for peak field up to 0.1 Tesla, *J. Phys. E, 7,* 266-268.

DUNLOP, D. J., J. A. HANES and K. L. BUCHA, 1973. Indices of multidomain magnetic behaviour in basic igneous rocks: alternating field demagnetization, hysteresis, and oxide petrology, *J. Geophys. Re., 78,* 1387-1393.

EVANS, M. E. and M. W. MCCLHINNY, 1969. An investigation of the origin of stable remanence in magnetite bearing igneous rocks, *S. Geormagn., Geoelect., 21,* 757-773.

FIRES, C., 1956. Bosquejo geológico de la región entre México, D. F. y Taxco, Gro. En: 20º Cong. Geol. Intern. Libreto-guía, Excursiones A-4 y C-2, P. H-36.

MCELHIMNY, M. W., 1973. Palaeomagnetism and Plate Tectonics, Cambridge University Press, 358 p.

MOLYNEUX, L., 1971. A complete result magnetometer for measuring the remanent magnetization of rocks, *Geophys. J. R. Astr. Soc., 24,* 249-433.

URRUTIA-FUCUGAUCHI, J., 1979. Significado y utilización de magnetizaciones de múltiples fases, *Anales Inst. Geof., 25,* pp. 101-123.