CRUSTAL DEFORMATIONS BELOW THE CENTRAL ANDES

Prof. Dr. J.L. TELLERIA-GEIGER

UMSA, LA PAZ-BOLIVIA (Email joseluisteller@yahoo.com)

ABSTRACT

A deformation of the Crustal Andes has been verified by several geophysical experiments since 1976.The studies included seismology, geochronology, seismic explosion below the pacific coast in Peru (1976), paleomagnetism (1980-1990), and gravity maps and models (1987-2000). Finally, all these data have been integrated and computed by 2D and 3D programs (originally Talwani method).

The greatest thickness of the earth crust (70 km) lies the Bolivian Altiplano. The high conductivity in the base of the mountain belt and other features, shows a new model of the earth crust for the plate tectonics activity.

1. INTRODUCTION – METHODOLOGY

Since 1960 the theory of Continental Drift (Wegener,1912), was the big mystery of the geophysicists. Then many experiments have been programed and execute to demonstrate this theory, after 30 years a new theory is born in the world: the PLATE TECTONICS.

My person has participated in all these experiments and reach results in Bolivia, Chile and Brazil, and presented in many congresses and journals.

In 1976, below the pacific sea in the coast of Peru, with Carnegie Institution of Washington, we execute many explosions to receive in many stations over the continent the seismic wave reflected of the upper zone of the lithosphere. Many groups of Scientifics from universities and institutions (Texas, Wisconsin, Carnegie, Japan, Bolivia Observatory and Geophysical Institute from Peru) was the protagonist of these big project. The results are in the *Annual Report of the Director Department of Terrestrial Magnetism of Carnegie (1976-1977)*

The seismic reflections were only the begin, after we needed other types of geophysical studies to verified the theory: isotopic measurements of rocks age from the sea floor, magnetic changes crossing the oceans, gravity interpretations of incredible minimum anomalies (minus 500 miligals) an many other complementary studies.

2. DESCRIPTION OF THE GEOPHISYCAL METHODS AND THE INTEGRATION DATA

ORIGIN OF THE MAIN CHALENGE. -

Just observed the earthquakes epicenters around the world comes to mint a repeating phenomenon every year. The seismic focus and epicenters are the same all the time. The same phenomena occur with volcanic distribution over the planet. These two geophysical evidences propose immediately a connection between earthquakes and volcanoes.

But how to demonstrate this connection, and how we can demonstrate that the surface of the earth is cover by many tectonic plates with relative movements? This was a very difficult task.

In gravity, how to demonstrate the incredible negative anomalies in the high mountains in the Andes? That phenomena included the strange electrical conductivity beneath the Andean Belt. If the plate tectonics is real, was necessary demonstrate that the rocks of the mid oceanic belts had a recent age, and the crust near to the ocean trench exactly the contrary. We needed a magnetic measurement across the oceans.

Many questions for a complex theory and many resources was needed for to execute the geophysical studies. That include money, researchers, ships, equipment, etc.

The program needs many special projects in many disciplines of the Geophysics. That's how they were born: INTERNATIONAL LITOSPHERE PROJECT, GEOTRANSECTS PROJECT, MAGNETIC PORTATIL RECORDS, OCEAN DRILLING, PALEOMAGNETISM, GEOCHRONOLOGY, and other related projects in PALEONTOLOGY, GEOCHEMISTRY, GEOLOGY, TECTONIC, COMPUTER SOFTWARES, ETC. The whole world mobilized around these projects. Many researchers died along the way.

I will resume the results:

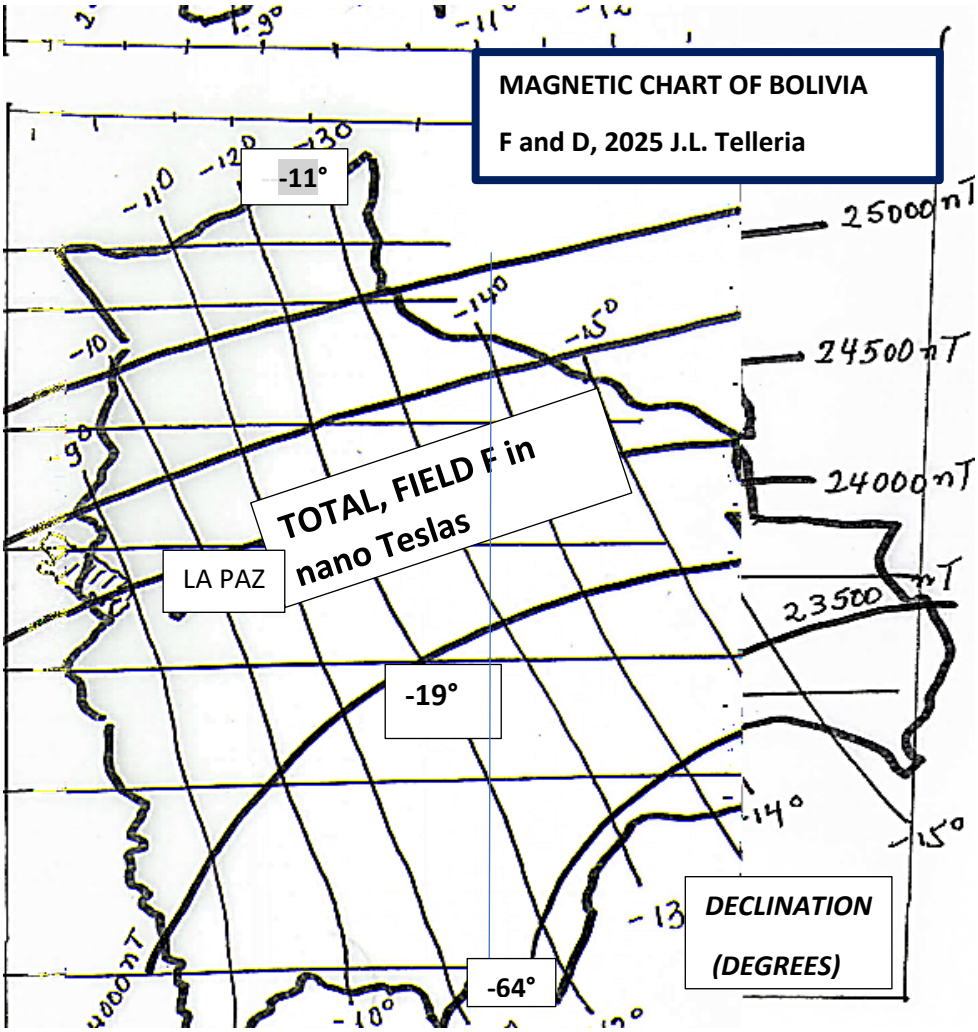


Fig. 1 Magnetic Chart of total FIELD (f) in Bolivia

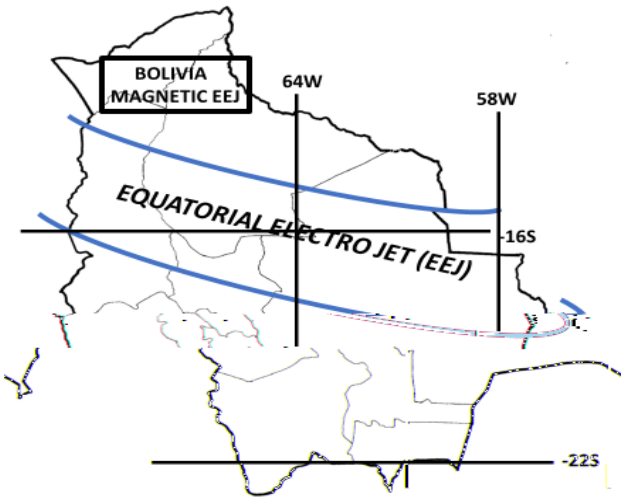


Fig 2 Equatorial Electro Jet in Bolivia (by J.L.Telleria-Geiger)

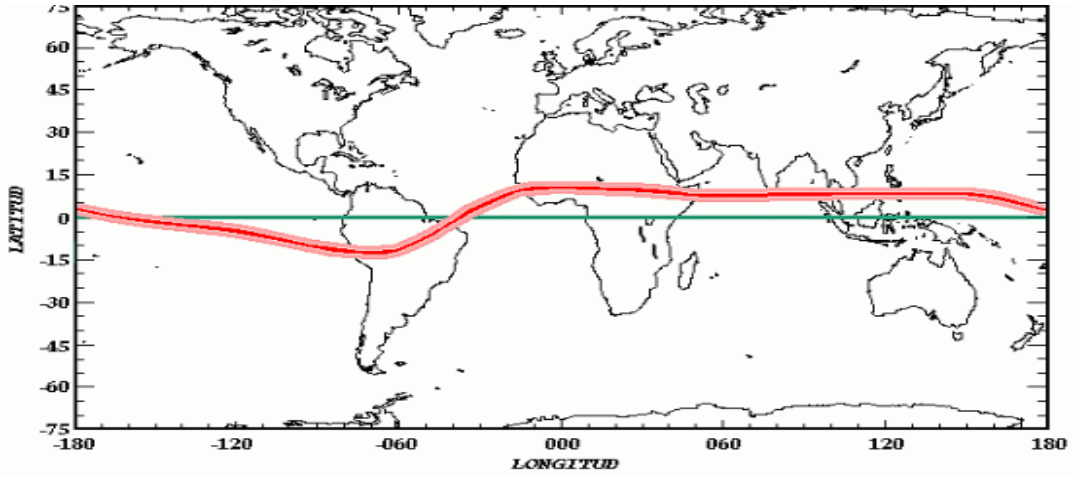


Fig3. Global geometry of the Equatorial electro Jet (EEJ)

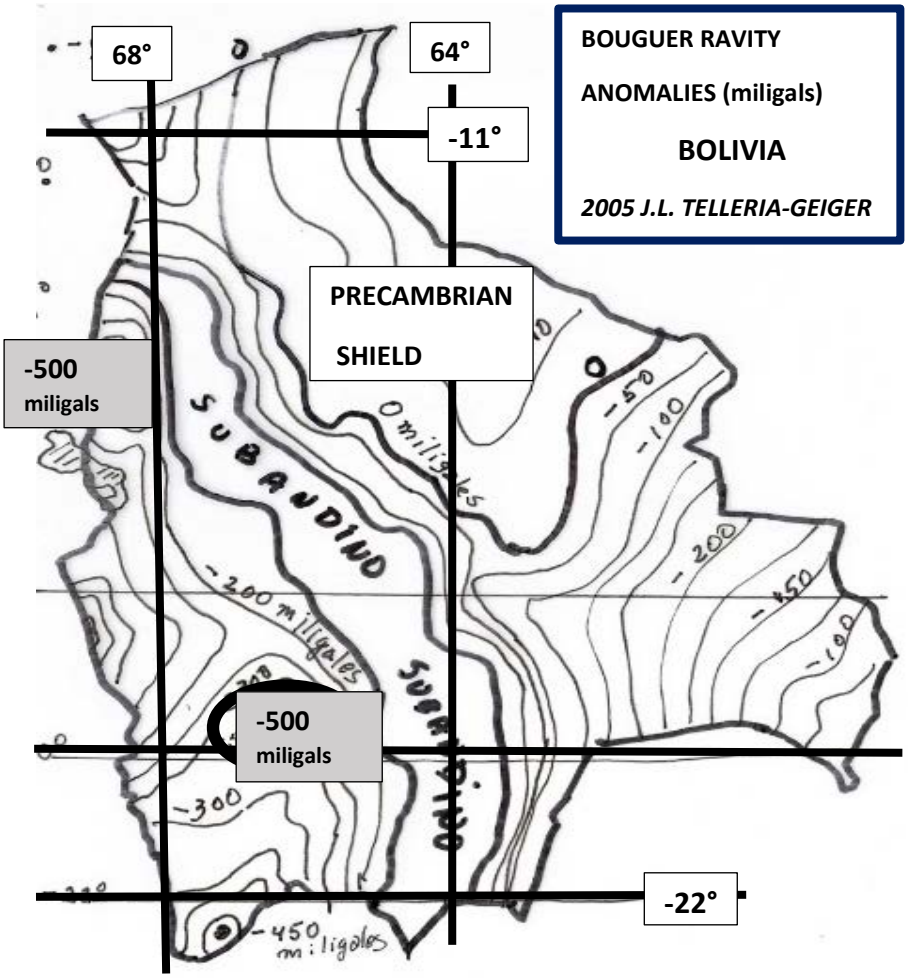


Fig 4. Bouguer Gravity Anomalies in Bolivia in miligals (by J.L. Telleria-Geiger)

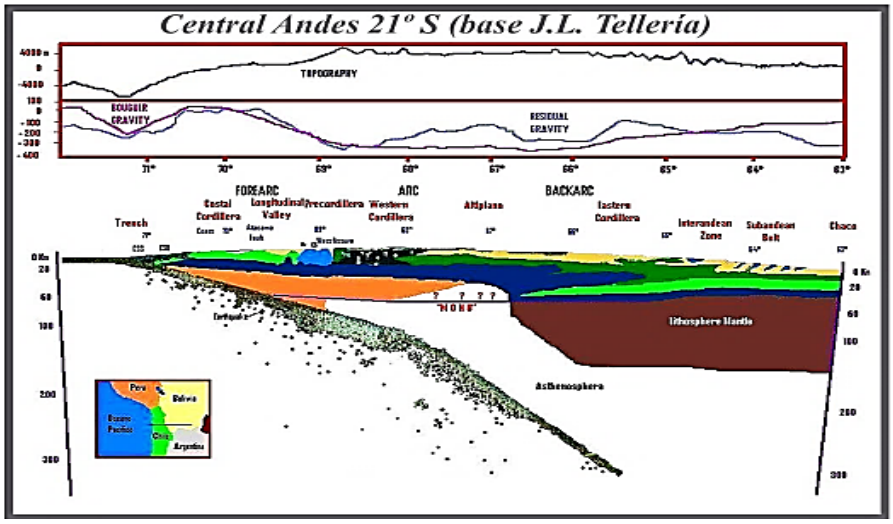


Fig 5. Geotransect acroos Bolivia-Argentina. Subduction of Nazca Plate

Fig. 6. GEODINAMICS CENTRAL ANDES ACROSS BOLIVIA GEOTANSECTS SAB-1 and SAB-2

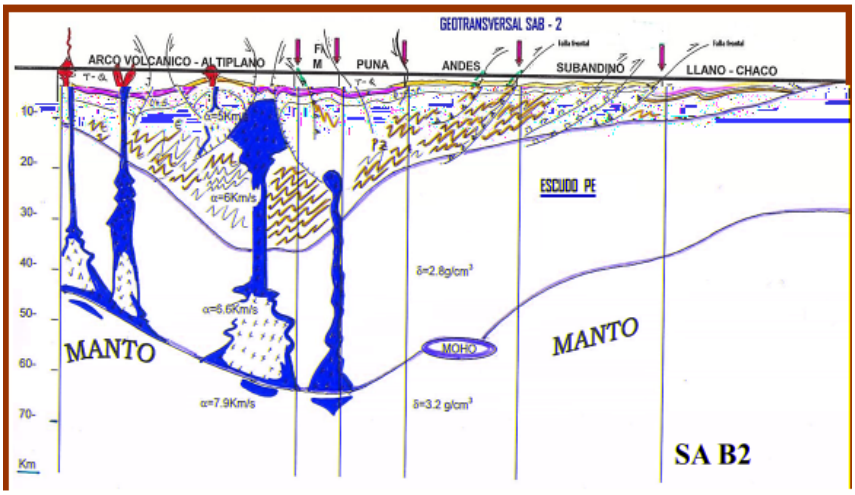


Fig 7. Crust model SAB-2 -border Brasil-Bolivia (by J.L.Telleria-Geiger)

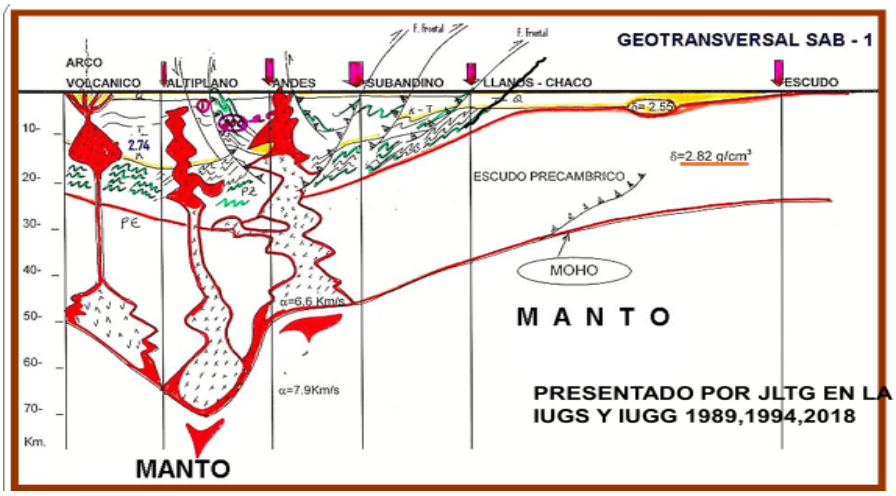


Fig 8 SAB-1, border Argentina-Bolivia (by J.L. Telleria -Geiger)

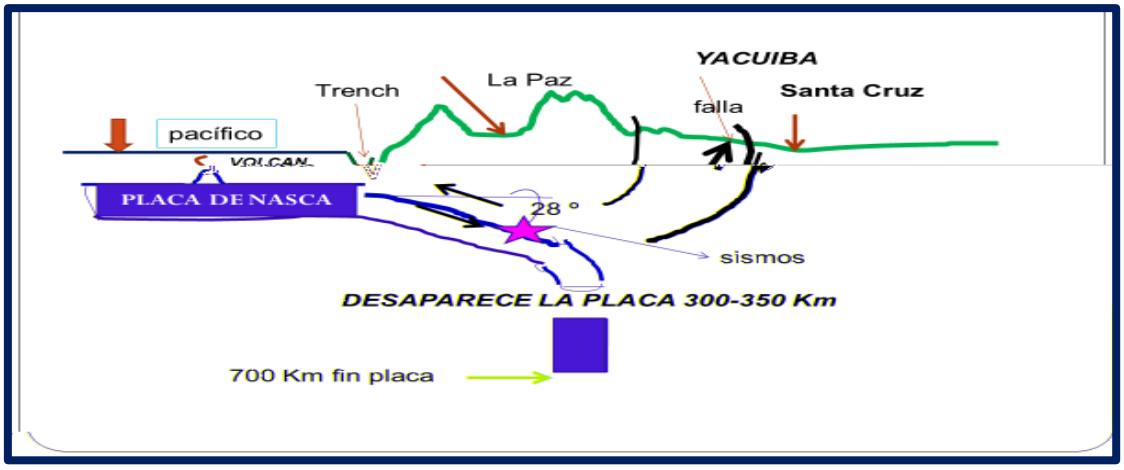


Fig. 9 Nazca plate below center of Bolivia (by J.L.Telleria-Geiger)

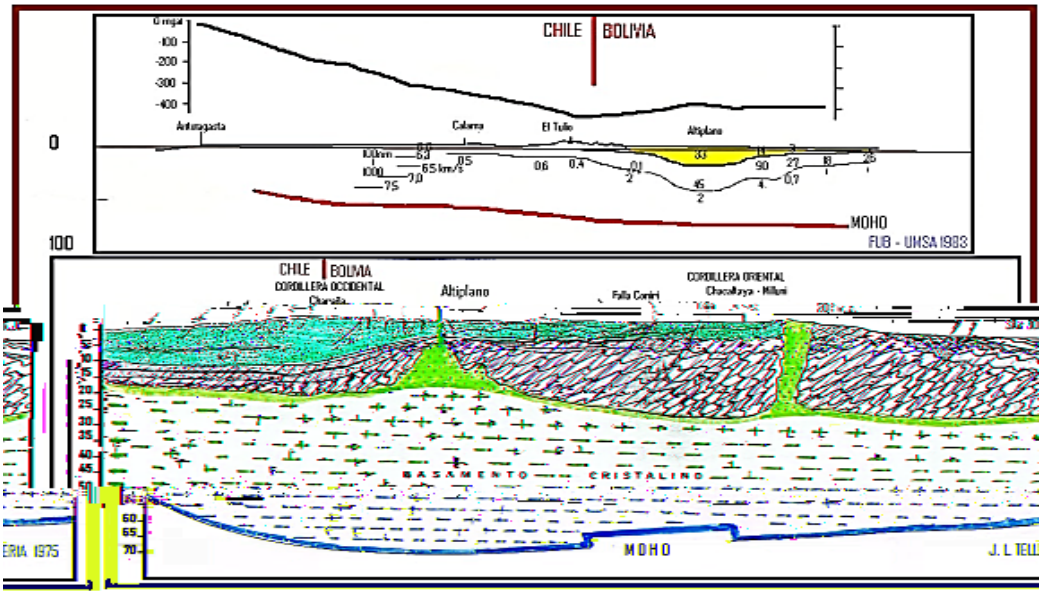
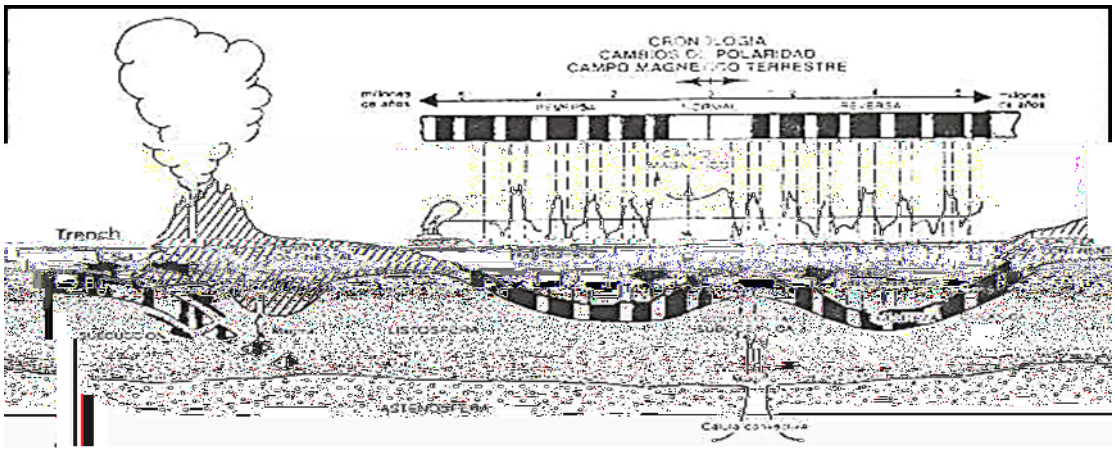
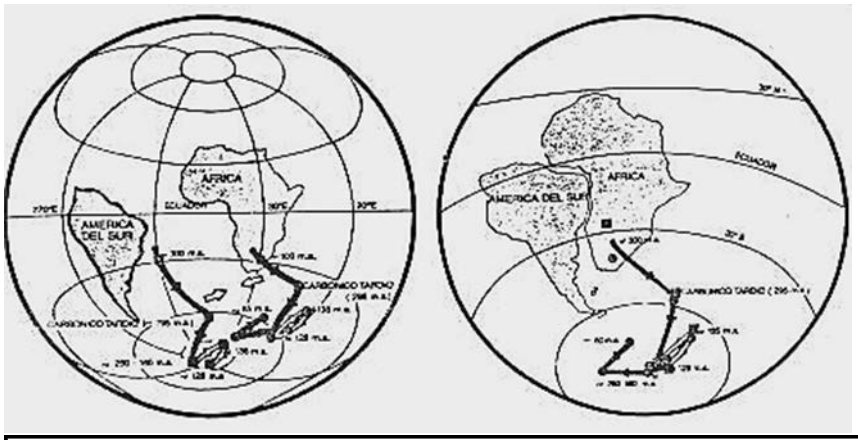


Fig. 10 FIRST CRUSTAL MODEL (1974) for Bolivia, using only gravity anomalies

Elaborated by J. TELLERIA and J. LEJSEK in 1974 (INT. FISICA- UMSA,LA PAZ)



Magnetic anomalies over the Atlantic sea floor (Normal and Reversed,UBA)



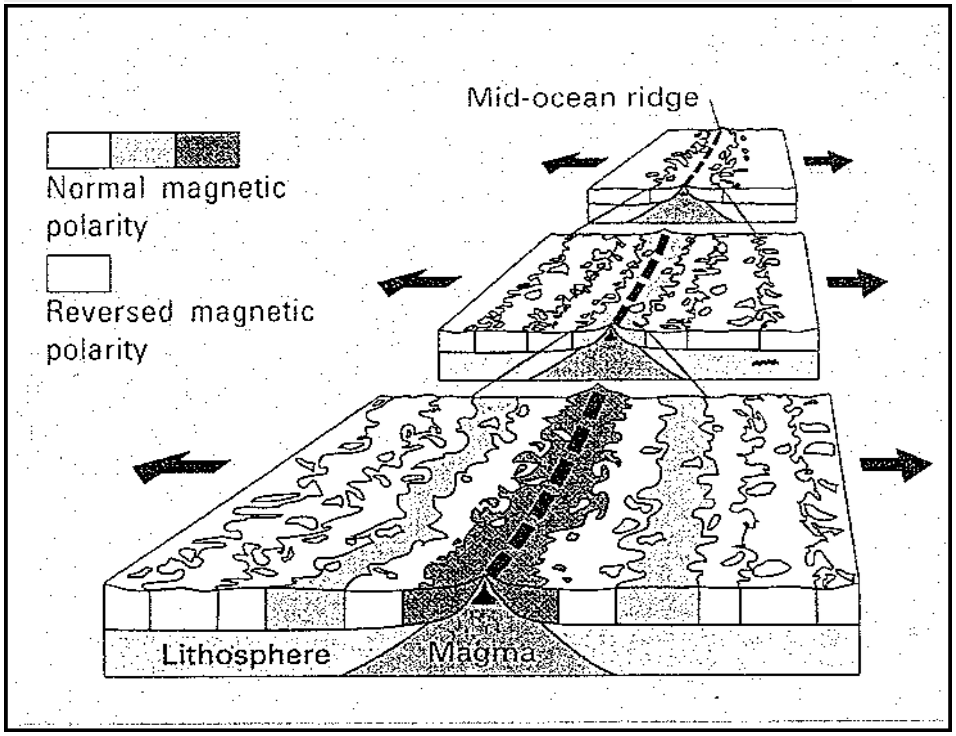


Fig. 11 Paleomagnetism showing reversal and normal magnetic anomalies spreading since the center rift in Atlantic Ocean (Paleomagnetism Lab, UBA, Argentina)

Nombre y País	**Sigla**	**Latitud**	**Longitud**	**Altitud**
Teoloyucan (México)	TAC	19.75° N	260.82°	2270
Chiripa (Costa Rica)	CRP	10.4° N	276°	1030
La Habana (Cuba)	HVN	……	……	……
San Juan (P. R)	SJG	……	……	……
Fúquene (Colombia)	FUC	5.47° N	286.26°	2540
Tatuoca (Brasil)	TTB	1.2° N	311.5°	0
Huancayo (Perú)	HUA	12.5° S	284.7°	3310
Patacamaya-Bol	**PTY**	**17.3° S**	**298.0°**	**3790**
La Quiaca (Argentina)	LQA	22.1° S	294.4°	3460
Vassouras (RJ, Brazil)	VSS	22.4° S	316.35°	450
Las Acacias (Argentina)	LAS	35.0° S	302.31°	10
Trelew (Argentina)	TRW	43.25° S	294.68°	20

Magnetic observatories installed for the international program in Lat America

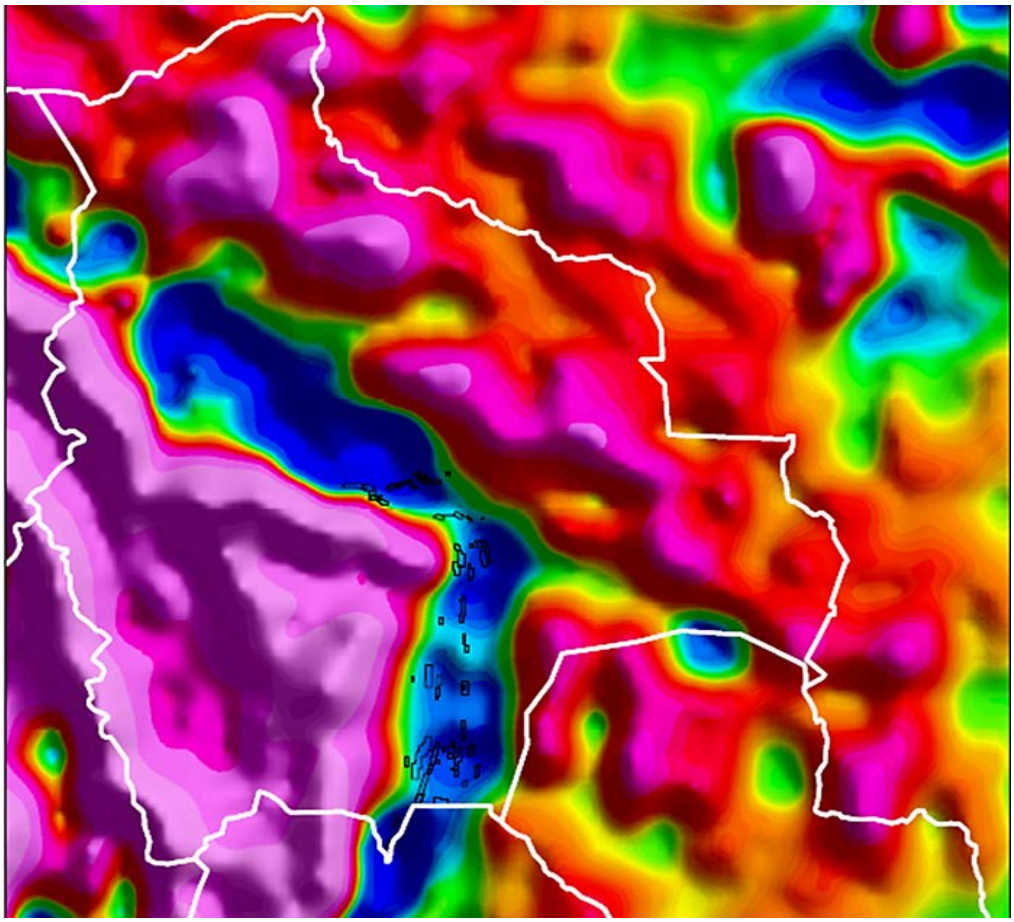


Fig 12 NEW MAP SHOWING THE **HIDROCARBONS** RESERVOIRS IN BOLIVIA

(based on gravity, magnetism and quantum electron from methane)

A new contribution to Oil companies by J. LTelleria-Geiger,2014. The blue shine zone shows the reservoir of hydrocarbons below de Suabandean Belt in Bolivia, Southern Peru and the North of Argentina and Paraguay.

3. CONCLUSIONS

1.- Paleomagnetism: the analysis of rock samples from Bolivia contributes to fill the geographic vectors showing the separation between Africa and South America. The analysis was directed by Prof. Daniel A. Valencio in UBA.

2.- Geochronology: the same rocks samples were dated by K/Ar method in the INGEIS-UBA and verified by prof. Kendal Creer in Edinburg.

3.- Magnetic Charts of Bolivia: 200 points have been measured by Telleria group (UMSA) and included brasil data in the border of Bolivia (kindly of Luiz Muniz Barreto, ON, Rio) for design 3 charts, total field F (in nano Teslas, nT), Declination (D) and Intensity (I).

4.- Magnetic observations along the Central Andes.- in 6 point located near to the mining districts of COMIBOL the Telleria Gropup have been installed a portatil magnetic instruments during 6 months, The resuls show a high conductivity of the rocks in the contato crus-mantle.

5.- Bouguer anomalies of gravity maps.- near to 20 000 poinst has been mesured over the roads in Bolivia by Telleria Group (UMSA), IGM and YPFB data.

6.- Magnetic Equatorial Band and Equatorial electro jett (EEJ).- it is a important electromagnetic phenomena presents over the equatorial magnetic zone, as a stripe used for telecomunications in all the countries around the world. Initially was discover observing a regular and systemics variations in the observatories of Pilar (Argentina, 1905) and Vassouras (Brasil, 1915). Actually all the observatories installed in Southamerica contributes to complementary studies of this phenomena. The EEJ is identify as a belt, aproximately of 600 Km width, centered on the Magnetic Dip Equator (I=0°).

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Prof. Luiz Muniz Barreto (Observatory Nacional, Rio de Janeiro), Prof. Victor Graterol, Prof. Daniel A. Valencio (Laboratory of Paleomagnetism UBA, Buenos Aires) and many other researchers, administrative people, students and fiends. UNT (Tucuman, Argentina, Prof, Posse and Geronimo Lopez)

INITIALS. – DTM-CIW Department of Terrestrial Magnetism-Carnegie Institution of Washington; IAGS Interamerican Geodetic Survey; IGM Instituto Geografico Militar de Bolivia: IGP Instituto Geofisico Peru; PAIGH Pan-American Institute of Geography and History- OAS; EMAR Energy Mines and Resources of Canada; UMSA Universidad Mayor San Andres, La Paz: UASB Universidad Simon Bolivar, Caracas; UBA Universidad Buenos Aires. UNT Universidad National de Tucuman.

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- Telleria, J.L. “Mapa geofísico electrón quantum of Bolivia”. Energy Press, 2012, Santa Cruz-Bolivia
- NB.- all the maps, profiles, transects, and papers belong to Prof. J.L. Telleria-Geiger, 40 year working on these themes. The results are presents in: Frei Universität fur Berlin (1977), International Centre for Theoretical Physics (Trieste, Italy), University of Aix in Marseille, Institute of Physics du Globe (Strasburg, France), Faculty of Sciences of Languedoc-Montpellier, University of Paris, Latin-American Universities and many geological and geophysical congress in the world.,