CRYPTIC AND PARTIALLY BURIED CALDERAS ALONG A STRIKE-SLIP FAULT SYSTEM IN THE CENTRAL ANDES.

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Resumen.

Se describen una serie de calderas cripticas y/o parcialmente soterradas, de edad Cenozoica, asociadas a lineamientos tectónicos de orientación NS y ONO-ESE en los Andes Centrales.

Key words: calderas - Central Andes - ignimbrites - strike-slip fault.

In the Central Andes (16°S-28°S) a major calcalkaline volcanic province (CVZ) developed from lower Miocene to the Present related to the subduction of the Nazca plate below the South American Plate.

One of the largest volumes of ash-flow sheets in the world is exposed in the Puna -Altiplano plateau (CVZ) ;but few of them are evidently related with known emission centers.

In the last years, a lot of ash-flow fields have been described (Guest, 1969; Baker 1981; Marinovic y Lahsen 1984; Kussmaul et al, 1977; Coira y Paris 1981; Gardeweg y Ramirez 1985) but few sources have been identified, mainly because of the large size of such structures, extensive mantling by younger volcanic units, interfingering of different sheets, the lack of precise field mapping and tectonic deformation.

More recently, available Landsat imagery and several detailed regional volcanological field studies facilitated to identify a few major calderas in the CVZ (Francis et al 1978 "Cerro Galán Caldera"; Davila, 1981 "Cailloma Caldera"; Noble et al 1979 "Pampas Galeras Caldera"; Noble and McKee, 1982 "Portugueza Caldera"; Gardeweg and Ramirez, 1987 "La Pacana Caldera"; Gonzalez Ferrán et al 1985 "Wheelwright Caldera"; Coira et al 1987; Ort et al, 1987 "Cerro Panizos Caldera"; Seggiaro et al 1986 "Pairique and Coranzuli complex"; Viramonte et al. 1984a "Ramadas Caldera" ; Llambías, 1971 "Farallón Negro complex", etc).

On the other hand, a close relationship between Cenozoic volcanism and major N-S structures and WNW-ESE transcurrent fault system between 22°S-28°S were established by Viramonte et al (1984) and Gonzalez Ferrán et al. (1985) for the Ojos del Salado area.

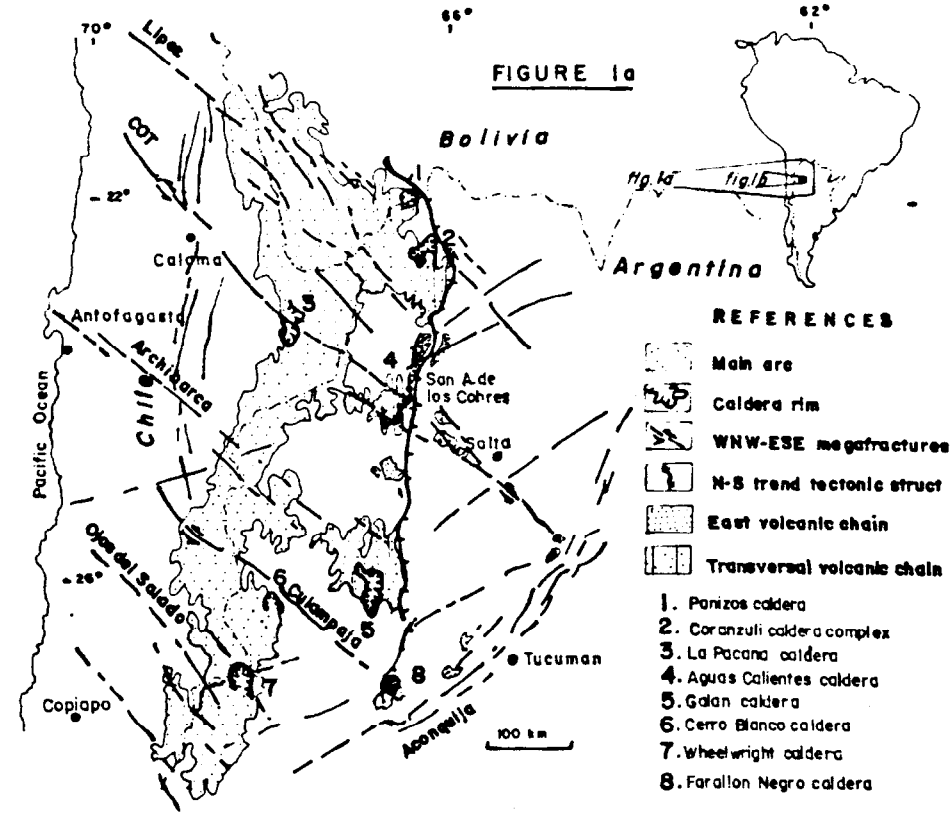
FIGURE 1a
70°
66°
62°
Lipez
COT
22°
Bolivia
Argentina
fig 1b
Calama
Antofagasta
Arch. Iquique
Chile
Pacific Ocean
San A. de los Cobres
Salta
Ojos del Salado
26°
Tucuman
Copiapo
Aconquija
100 km
REFERENCES
Main arc
Caldera rim
WNW-ESE megafractures
N-S trend tectonic struct
East volcanic chain
Transversal volcanic chain
1. Ponizos caldera
2. Coranzuli caldera complex
3. La Pacana caldera
4. Aguas Calientes caldera
5. Galan caldera
6. Cerro Blanco caldera
7. Wheelwright caldera
8. Farallon Negro caldera

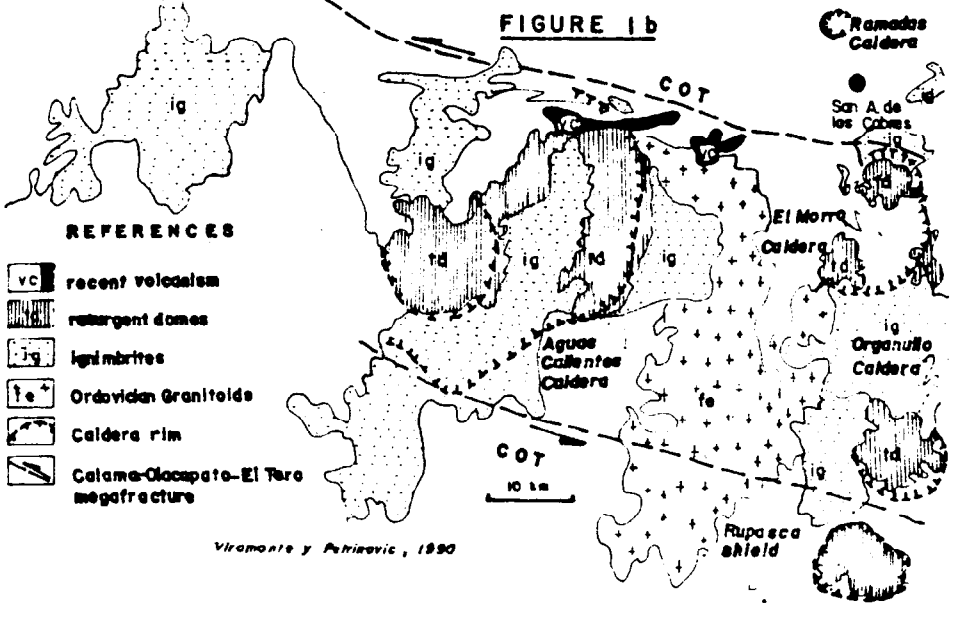
FIGURE 1b
Ramadas Caldera
COT
San A. de los Cobres
El Morro Caldera
Aguas Calientes Caldera
Organullo Caldera
Rupasca shield
10 km
REFERENCES
recent volcanism
resurgent domes
ignimbrites
Ordovician Granitoids
Caldera rim
Calama-Olacapato-El Toro megafracture
Viramonte y Petrinovic, 1990

This relationship produced: a) the N-S trend main magmatic arc along the Argentine-Chilean-Bolivian boundary (principal volcanic range), b) the secondary volcanic range, located on the Puna-Western Cordilleran border and c) the WNW-ESE Transversal Volcanic Chains that developed to the east of the first one (Viramonte et al 1984b) (fig 1a) such as:

1) Lipez Megafracture, related to Panizos-Coranzuli Transverse Volcanic Chain.

2) Calama-Olacapato-El Toro (COT) left lateral Transcurrent fault with Puntas Negras- Quevar volcanic chain.

3) Archibarca-Galan megafractures with Archibarca-Beltran-Galán Volcanic chain.

4) Culampajá Megafracture with Carachipampa-Farallón Negro Volcanic chain.

5) Tucumán-Aconquija megafracture with Ojos del Salado-Wheelwright volcanic chain.

A detailed analysis of this volcano-tectonic relationship, suggests that the main ignimbrite sources (caldera complex) in the CVZ, are in the transversal volcanic chain system and-or in the NS-volcanic arcs-Transversal volcanic chain intersections (figure 1a). Altough the Puna-Altiplano region is highly preserved in its geology, in several cases the above described situation produces a darkening of the true ignimbrite source structures, because of beheading, deformation, lack of caldera rim, covering by younger volcanic units, avalanches, etc., due to the movements of the megafractures. i.e.: strong deformation in the north end of the resurgent La Pacana dome and lack of its northern caldera rim (see Gardeweg and Ramirez, 1987, pp. 549, fig.2 and 9), lack of the northern rim and beheading of the Aguas Calientes caldera complex (figure 1b) and deformation in the Acay subvolcanic granitic complex (see Llambias et al, 1985 pp. 160), due to transurrent movement of the COT megafracture.

Keeping this in mind, we found a good example of cryptic and partially buried calderas in the central area of COT megafracture where at least five ignimbrite sources exist (figure 1b): Aguas Calientes Caldera complex ;El Morro caldera; Organullo caldera; Rupasca shield and Ramadas caldera.

An overview of the CVZ reveals that such examples should be quite common. Considering the large volumes of ignimbrites in the Central Andes, we believe that over one hundred associated caldera structures must be present, such as Smith (1979) has showed for western United States.

At last, we point out the importance of the recognition of this type of caldera complex and its evolutive history because many large epithermal Au-Sb;Pb-Ag-Zn and Cu ore deposits are associated to them.

References.

BAKER, M.C.W. (1981): The nature and distribution of Upper Cenozoic ignimbrites centres in the Central Andes. J.Volc.Geoth.Res. 11:293-315.

COIRA, B. AND PARIS, R. (1981): Estratigrafía del área volcánica del Cerro Tuzgle. 8º Cong.Geol.Arg. 3:659-671.

COIRA, B., MAZZONI, M. y J.C. MERODIO (1987): Cerro Panizos: un centro emisor dacítico, Jujuy, Argentina. Decimo Congreso Geologico Argentino. Actas 4: 338-340.

DAVILA, M.S. (1981): Cailloma:caldera tipo Valle.Boletin Soc.Geol. Perú. 68:25-35.

FRANCIS, P.W., HAMMILL, M., KRETZSCHMAR, G., THORPE, R.S. (1978): The Cerro Galán Caldera, NW Argentina and its tectonic setting. Nature 274: 749-751.

GARDEWEG, M. y RAMIREZ, C.F. (1985): Hoja Río Zapaleri. Carta Geológica de Chile. Serv.Nac. de Geol y Miner nº66.

GARDEWEG, M. y RAMIREZ, C.F. (1987): La Pacana caldera and the Atana ignimbrite. A major ash-flow and resurgent caldera complex in the Andes of northern Chile. Bull. Volcanol.. 49:547-566.

GONZALEZ FERRAN, O., BAKER, P.E. & REX, D.C., (1985): Tectonic-volcanic discontinuity at latitude 27° S Andean range associated with Nazca plate subduction. Tectonophysics 112: 423-441.

GUEST, J.E. (1969): Upper Tertiary ignimbrites in the Andean Cordillera, Antofagasta provicnce, North Chile. Geol. Soc. and Bull. 80:337-362.

KUSSMAUL, S., HORMANN, P.K., PLOSKONKA, E. and SUBIETA, T. (1977): Volcanism and structure of southwestern Bolivia. J. Volcanol.Geotherm.Res. 2:73-111.

LLAMBIAS,E.J. (1970): Geología de los yacimientos mineros de Agua de Dionisio. Rev. de la Asoc. Arg. de Mineral.. Petrol. y Sediment. 1(1-2): 2-32.

MARINOVIC, N. & LAHSEN, A., (1984): Hoja Calama, Región de Antofagasta. Serv. Nac. de Geol. y Mineral. Carta Geol. de Chile. 58 pp 140.

NOBLE, D.C. FARRAR, E. & COBBING, E.J., (1979): The Nazca group of South-Central Perú: Age, source and regional Volcanic and Tectonic significance.Ear.Pl.Sci.Let45:80-86

NOBLE, D.C., McKEE, E.H., (1982): Nevado Portugueza volcanic center, Central Perú: a Pliocene central volcano collapse-caldera complex with associated silver mineralization. Econ. Geol. 77:1893-1900.

ORT, M., COIRA,B., MAZZONI,M., FISHER,R.V. y MATTINSON, J.M., (1987): Volcanismo ignimbrítico del Cerro Panizos, Jujuy Argentina.Dcimo Congreso Geológico Argentino. Actas 4:335-337.

SEGGIARO, R., GORUSTOVICH, A. y MARTI, F., (1986): Las ignimbritas del complejo volcánico Coranzuli (Puna Argentina-Andes Centrales). Est.Geol. 43(5-6):345-359.

VIRAMONTE, J.G., OMARINI, R.H., ARAÑA, V., APARICIO, A., GARCIA CACHO, L. y PARICA, P., (1984a): Edad, Genesis y mecanismos de erupción de las riolitas granatíferas de San Antonio de los Cobres, provincia de Salta. Noveno Congreso Geológico Argentino. Actas III: 216-233.

VIRAMONTE, J.G., GALLISKI, M.A., ARAÑA, V., APARICIO, A., GARCIA CACHO, L. y MARTIN ESCORZA, C., (1984b): El finivulcanismo básico de la depresión de Arizaro, provincia de Salta. Noveno Congreso Geológico Argentino. Actas III: 234-251.