STRUCTURE AND GEOTHERMIC POTENTIAL OF THE ROSARIO DE LA FRONTERA THERMAL AREA, SALTA, ARGENTINA

R. Seggiaro, N. Aguilera, E. Gallardo and J. Ferretti

UNIVERSIDAD NACIONAL DE SALTA - CIUNSA - ARGENTINA

CONTRIBUTION TO CIUNSA 408 PROJECT

Key words: structure, geothermal, geochemistry

Abstract

The work carried out in Kosario de la Frontera geothermal area consisted of geologic mapping, construction of stratal lengths and excess area controls, structural balanced cross sections and water sampling of thermal springs for geochemical analysis. The structural cross section and the permeabilities of the different geological units, suggest a hydrologic circulation cycle, a recharge zone, the Rio Seco Formation as the main aquifer, and a maximun depth of 3000 m.

A source temperature ranging from 90°C to 130°C was obtained from the K-Mg and SiO_2 geothermometers. Geochemical analysis indicates different proportions of mixing with shallow waters and low enthalpy origin for all the hot water samples.

Introduction

The Rosario de la Frontera geothermal area is located in northwest Argentina (65° W., 25°50' S.). It belongs to a group of thermal manifestations aligned in the eastern belt of the Subandean fold thrust system.

The Subandean foreland fold belt system is located approximately 200 km east of the Central Andes cenozoic volcanic arc.

The area is located near Rosario de la Frontera city, between Salta and Tucuman cities, one of the richest and most developed agricultural regions of north-west Argentina.

There are 6 hot springs in the study area. The temperatures near 90°C and the abundant water volume are promising features for a geothermal explotation in the future.

Geology

The PreQuaternary geologic history of the Rosario de la Frontera geothermal area has been discussed in general geologic and geothermal studies by Nesossi (1947), Moreno Espelta et al. (1975), Arias (1975) and Arias et al. (1975).

The geodynamic environment of the study area is dominated by a thin skinned compressive deformation as the main regional structural style.

The La Candelaria and Cerros de la Iglesia ranges are topographic features (figure 1a) corresponding to structural blocks elevated by fault planes dipping to the west. They follow a regional eastern vergence.

The structural features are dominated by flexures and propagation faults with deep detachments (figure 1b).

The structural cross section shown in figure 1b was carried out by balanced reconstruction using stratal lengths and excess area controls methods. The balanced cross section shows a 10,000 m maximum detachment surface responsible for the elevation of the La Candelaria range. Intermedium detachments between the metamorphic Medina Formation Basement and Cretassic Pirgua Subgroup were also considered.

Geochemistry

The contents of major chemical species in thermal hot waters of Rosario de la Frontera geothermal field are given in Table 1. Samples MI, M3, M4 and M5 are classified as dilute bicarbonate or perispheric waters according to the Ellis and Mahon (1977) classification. Only M2 and M6

Table 3: Relative permeability c the rocks outcroping at Rosario de la Frontera thermal area

	FORMATION	DESCRIPTION	REFERENCES	PERMEABILITY
ertiary	Piquete	Conglomerates and sand-.tonesnon-consolidated	High Permeability	High permeability by porosity
	Guanaco	Conglomerates and coarse sandstones	High Permeability	High permeability by porosity
	Jesus Maria	Medium sandstones	High Permeability	High permeability by porosity
	Anta	Fine silty sandstones and green pelites	Impermeable	Low permeability to inpermeable
	Rio Seco	Medium sandstones	High Permeability	High permeability by porosity
	S. Bárbara Subgroup	Sandstones and pelites	Low Permeability	Low permeability with inpermeable levels
retaceous	Yacoraite	Limestones and pelites	Low Permeability	Low permeability to inpermeable
	Lecho	Medium sandstones	High Permeability	High permeability by porosity
	Pirgua Subgroup	Conglomeradity sand-tones and conglomerates	Middle Permeability	Middle permeability by cracking
roterozoic	Medina	Metamorphic rocks with quartz veins	Low Permeability	Low permeability by craclung

References

Arias, J.E. (1975). ***Geologia del area del arroyo Las Bateas, Sierra de la Candelaria. Dpto. de Rosario de la Frontera, Provincia de Salta.*** Universidad Nacional de Salta, Dpto. Cs. Naturales. Seminario I. Inedito. Salta.

Arias, J. E.; Chavez, A. y Moreno Espelta, C. (1986). ***Distribución de localidades hidrotermales de las provincias de Jujuy y Salta, Republica Argentina.*** Universidad Nacional de Salta, INENCO. Salta.

Ellis A.J. and W. Mahon, (1977). ***Chemistry and Geothermal Systems.*** Academic Press Inc, London, UK, 39 lp.

Giggenbach W.F. (1988). Geothermal solute equilibria-Derivation of Na-K-Mg-Ca geoindicators. ***Geochim. et cosmochim.*** Acta 52,2749-2765.

Giggenbach W.F. and R. Corrales Soto (1992). Isotopic and chemical composition of water and steam discharges fiom volcanic-magmatic-hydrothermal systems of the Guanacaste Geothermal Province, Costa Rica. Applied ***Geochemistry,*** Vol. 7, **pp.** 309-332.

Moreno Espelta, C.; Viramonte, J.G. y Arias, J.E. (1975). Geologia del área termal de Rosario de la Frontera y sus posibilidades geoquimicas. *II Congr.* ***Ibero-Americano de Geologia Económica***. T. IV, P.543-548. Buenos Aires. Argentina.

Nesossi, D. (1947). ***Estudio geológico de los departamentos de Rosario de la Frontera y Candelaria, Provincia de Salta.*** Yacimientos Petroliferos Fiscales. Inedito. Buenos Aires.