

Exploration and definition of the 320 MW (inferred) resource; Mariposa Geothermal System, Chile

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Summary

Magma Energy Corp, a Vancouver based pure-play geothermal company, was incorporated in late 2007. The company was the brainchild of entrepreneur and business man, Ross Beaty. Mr. Beaty was known in mineral exploration circles, but Magma was his first venture into geothermal space. In addition to Canada, the company established subsidiary companies in Argentina, Chile, Iceland, Italy, Nicaragua, Peru, and the USA. It also acquired a number of greenfield geothermal exploration leases globally in the 2008 – 2010 time period as well as operating assets in Iceland (HS Orka) and Nevada (Soda Lake). In September 2008, Magma, through its Chilean subsidiary, Magma Energy Chile, acquired the 40,000 ha Laguna del Maule exploration lease, renamed the Mariposa Geothermal System (MGS) (Figure 1). Under Chilean law, the exploration lease expired June 30, 2009, unless a resource could be identified and proven by drilling. Magma started exploration in January 2009, completing a significant series of geological, geochemical and geophysical investigations. The result of the geochemical and gas analysis of surface fumaroles and hot springs indicated the potential for a relatively near surface high temperature resource (Table 1). Following these analyses the decision to run a 79 station MT survey was taken and the survey was carried out in March 2008. The survey identified several low resistivity targets (Figure 2). From the results of the various geological, geochemical and geophysical studies a conceptual model was devised (Figure 3). With the results in hand, a slim hole drilling campaign commenced to drill MP 01, the heavy lift helicopter supported well to a depth of 1 km in an effort to prove the resource prior to the expiration of the lease. Despite Chilean winter conditions, including a 48 hour-1.6m snow fall event. Drilling problems forced the well diameter from the planned PQ diameter to BQ. The BQ hole was not large enough to run the Kuster temperature logger on wire line, so it was inserted into the BQ tubing, appropriately slotted and capped. A temperature reading of 202°C at 650 m was obtained and then the well site was abandoned in the face of additional snow and harsh winter conditions. The documentation of a temperature in excess of 170°C (the required minimum) provided the legal basis to submit documentation to the Chilean authorities, thus converting the lease to an exploitation lease, with an indefinite lease period. At the same time, an exploration lease was given for the adjoining Pellado area (Figure 1).

With the exploitation lease secured and a new exploration lease in hand, Magma continued its exploration efforts running another MT survey, as well as a gravity survey. Continued geological mapping was also carried out. Starting in September 2009, a road was built into the area and lower and upper camps were built to house 60 people. Drilling of MP 02 began in March 2010, followed by MP 03 in July. Both slim holes drilled with coring rigs. Avalanche control was necessary along the access road, to allow for winter drilling. Exploration continued with the development of additional roads, pads and sumps until 2012. In 2012 Magma Energy merged with another Canadian renewable energy company, Plutonic Power, who were focused on wind, solar and run-of-river hydro. The merged company became Alterra Power. However, the

economics of geothermal projects in the face of lower exploration and development costs of wind, solar, and hydro spelled the death knell for geothermal within the company.

In 2013, Alterra Power divested itself of a number of its assets and signed Joint Venture agreements for several of its properties, among them MGS. The Mariposa system was joint ventured to the Philippine company, Energy Development Corporation. The project remains static due to unfavorable electricity prices in Chile.

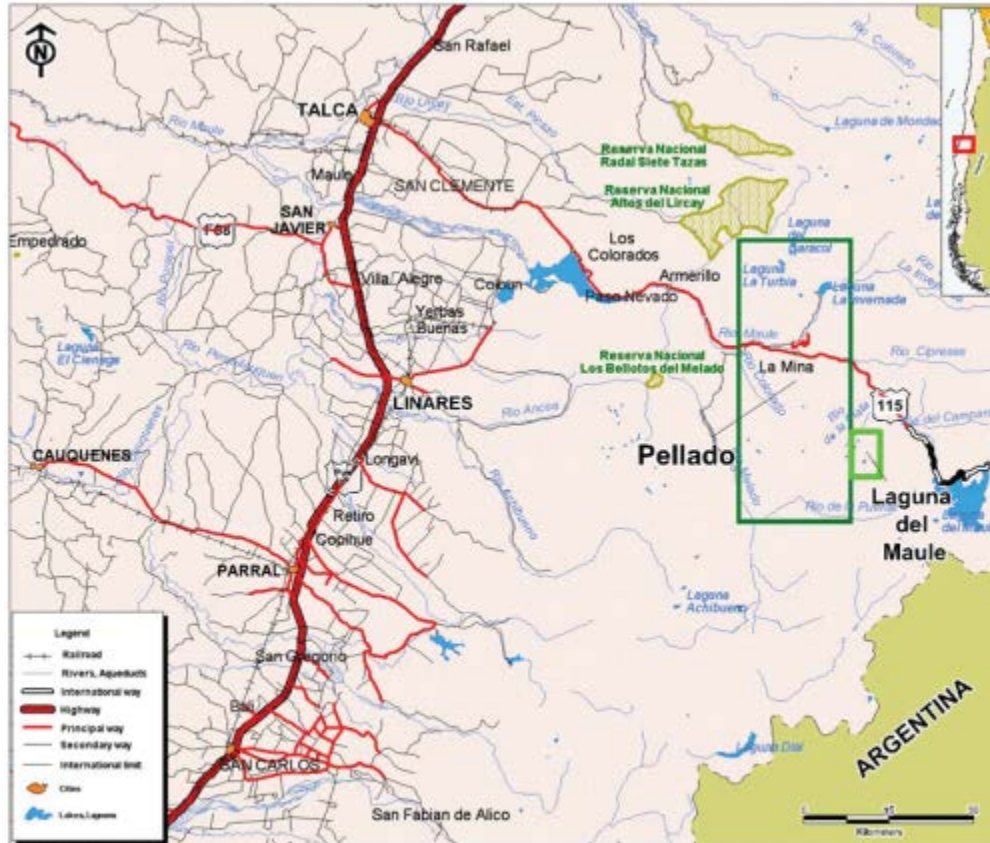


Figure 1. Location map showing Laguna del Maule exploitation concession (light green) and Pellado exploration concession (dark green).

Table 1. Gas thermometry data for MGS fumaroles samples.

| Date | Locality | T °C H₂/Ar, Giggenbach 1991 | T °C Dámore & Panichi, 1980 |
|-------------|-----------------|---|--|
| 7-Mar-09 | Los-Hoyos | 272,2 | 270,0 |
| 7-Mar-09 | Los-Hoyos | 255,8 | 230,5 |
| 7-Mar-09 | La-Plata | 291,6 | 296,4 |
| 7-Mar-09 | Pellado | 284,4 | 285,7 |
| 8-Mar-09 | Pellado | 287,6 | 250,4 |
| 13-Mar-10 | Pellado | 284,7 | 242,7 |
| 13-Mar-10 | Pellado | 284,2 | 242,2 |
| 13-Mar-10 | Pellado | 283,8 | 239,8 |
| 12-Mar-10 | La-Plata | 282,2 | 291,0 |
| 14-Mar-10 | La-Plata | 290,1 | 291,3 |

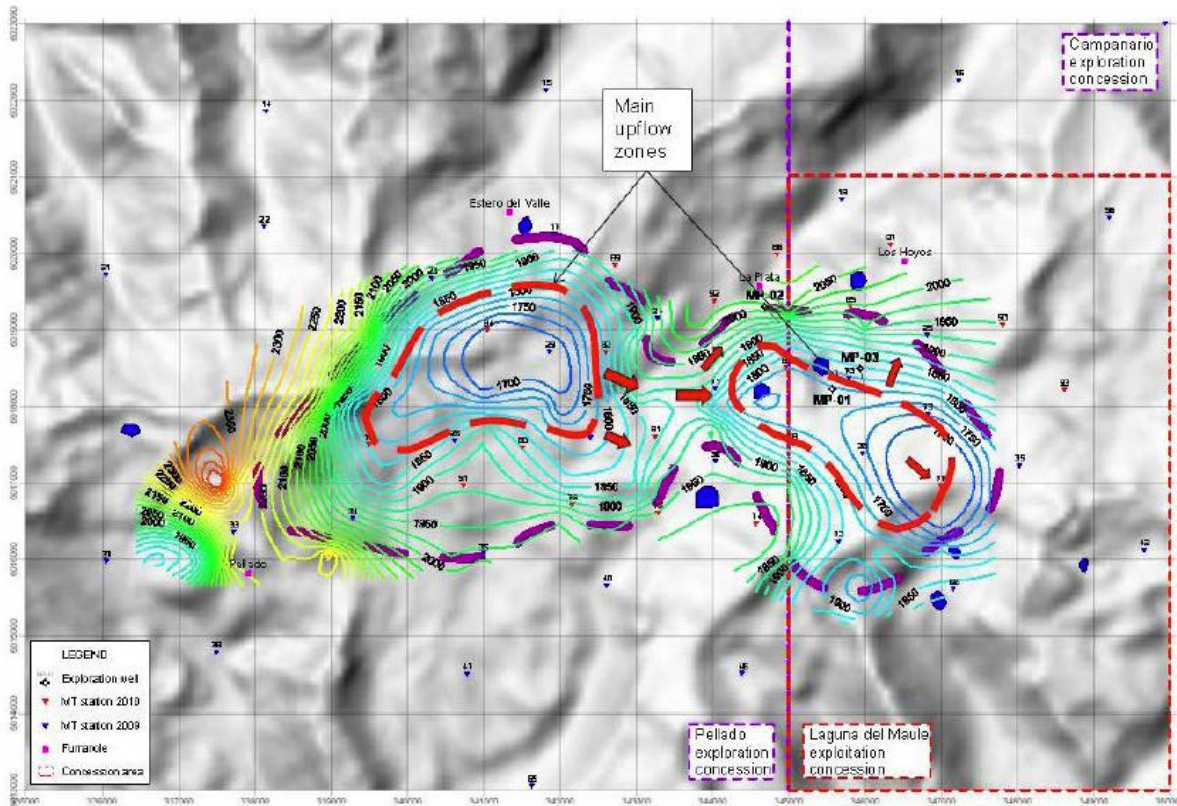


Figure 1: Results of the 2009 and 2019 MT surveys, showing an extensive area of alteration.

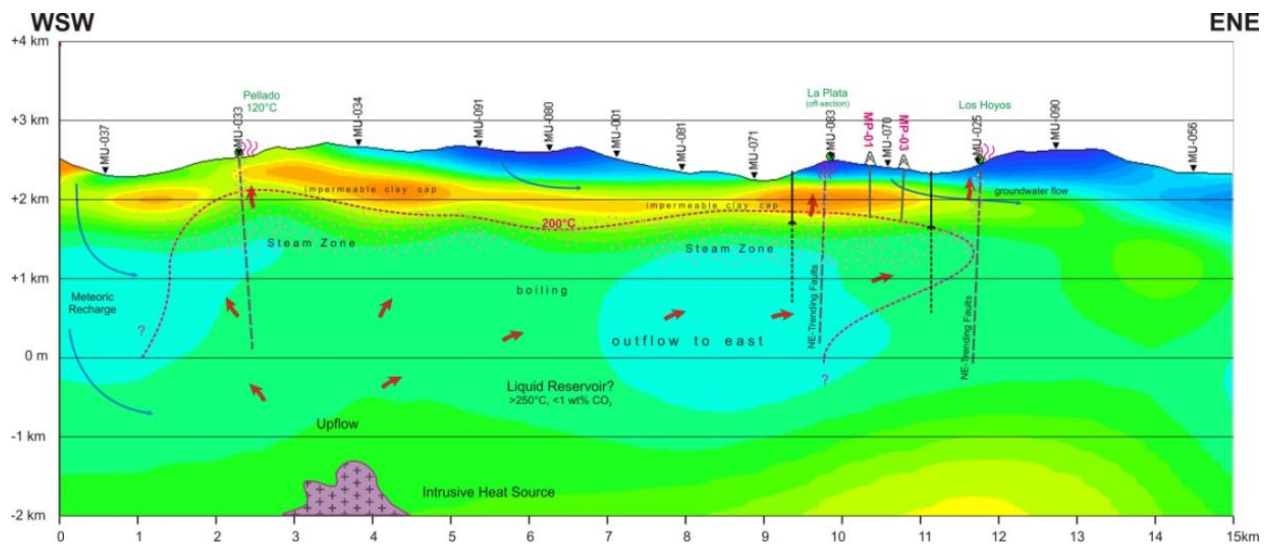


Figure 3: Conceptual model of the MGS showing the location of the three drill holes and clay cap.

Acknowledgements

The rapid exploration of the original Laguna del Maule lease area took an extraordinary effort on the part of many people. The geoscience and drilling team consisted of C. J. Hickson, F. Ferraris, C. Rodriguez, G. Sielfeld, R. Henriquez, T. Gislason, J. Selters, D. Benoit, P. White, J. Southon, G. Ussher, J. Charroy, A. Smith, B. Lovelock, J. Lawless, P. Quinlivan, L. Smith, and R. Yehia. In addition, the efforts of Chilean based GeoTec Drilling were commendable especially under winter conditions. The road builders, construction crews and camp service staff are all thanked for their efforts. The efforts of this diverse team of geoscientists, engineers, technologists, and workers helped prove a significant geothermal resource, that hopefully will be developed to its full potential in the fullness of time.

References

Mariposa Geothermal System, 2011, C. J. Hickson, F. Ferraris, C. Rodriguez, G. Sielfeld, R. Henriquez, T. Gislason, J. Selters, D. Benoit, P. White, J. Southon, G. Ussher, J. Charroy, A. Smith, B. Lovelock, J. Lawless, P. Quinlivan, L. Smith, and R. Yehia, Transactions, Geothermal Resources Council, Volume 35, 2011, p 817-825.