KINGDOM OF MOROCCO

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المكتب الوطني للهيدروكاربورات و المعادن

OFFICE NATIONAL DES HYDROCARBURES ET DES MINES

ANNULAR STRUCTURE OF LAMLAGA (REE, Nb, Fe, V, Au, Mo)

(Southern Provinces, Morocco)

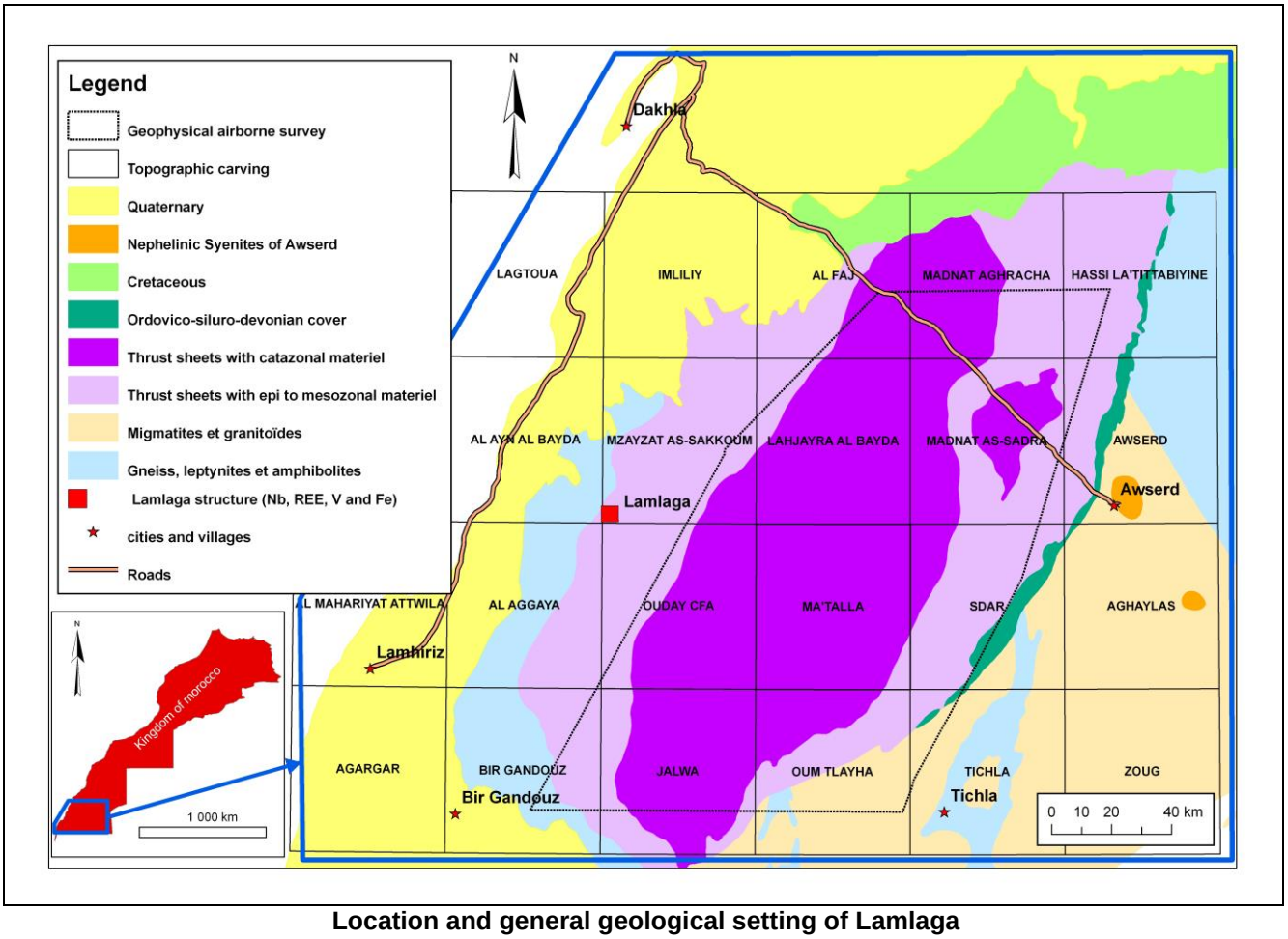
February 2016

KEY POINTS

- Volcanic structure of vuggy silica, iron oxides and carbonatites;
- Annular structure linked to magnetic and radiometric anomaly;
- High grade of Niobium, REE and Iron with indicial grades of V, Au and Mo;
- Plurikilometric extent;
- Proximity to Twihinate prospect.

LOCATION AND INFRASTRUCTURE

The prospect of Lamlaga is located to the South west part of the 1/100000 scale topographic sheet of Mzaysat As-Sakkoum. It is accessible by 210 km of asphalt road and 50 km of carriageable track from Dakhla.



Location and general geological setting of Lamlaga

REGIONAL GEOLOGY

The Proterozoïc formations of the sector are represented by two distinctive blocks:

An oriental Archean block stable and autochthonous being part of the West-African shield

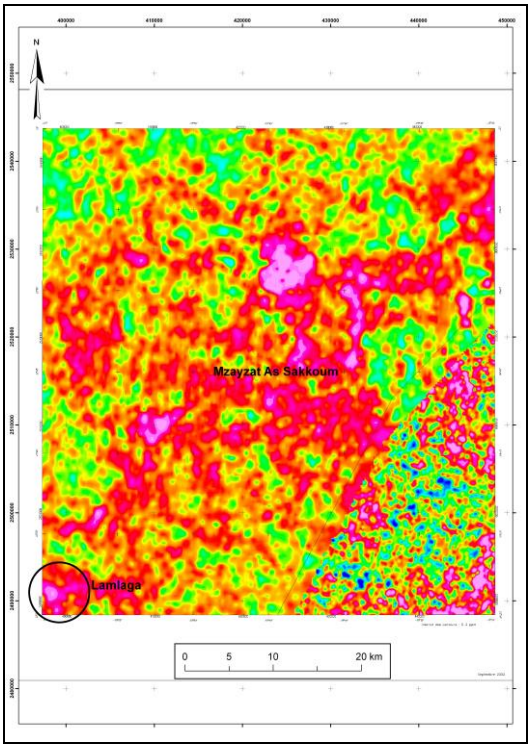
A western allochthone block, constituted by thrust sheets formed during the hercynian orogeny; the age of the formations of this block stretched out NNE-SSW is from Palaeozoic to Archean.

LOCAL GEOLOGY

Lamlaga is located 10 km north of Twihinate prospect; the geological survey achieved in Lamlaga shows a big annular structure of about 2.5 km of diameter that crosses Proterozoic gneiss. This volcanic structure includes a main mass and a peripheral ring that has a crescent shape. These two parts are separated by a large depression filled with quaternary formations.
The main mass is essentially composed of varied vuggy breccia silica and iron oxides; the peripheral ring is constituted mainly of iron oxides.
The mineralization in Rare earths elements and Niobium has been found either in iron oxide and breccia silica.

EXPLORATION WORK AND RESULTS

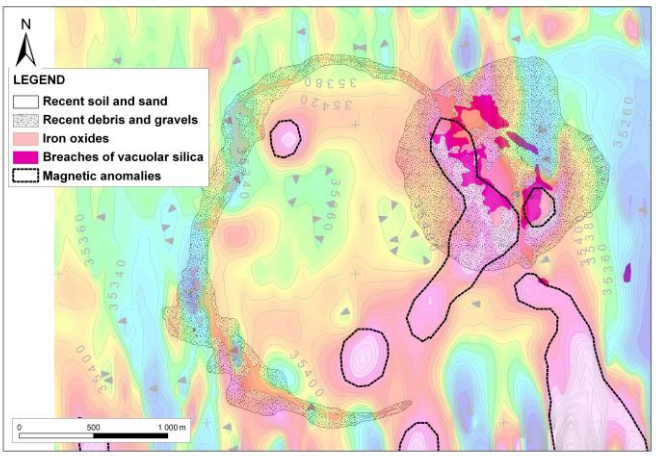
The magnetic and radiometric data of Mzaysat As-Sakkoum were obtained by the interpretation of the aero magnetic and spectrometric survey done by Sander Geophysics on the southern part of Morocco. Several anomalous were individualized and have undergone geological check which led to the discovery of Lamlaga structure.



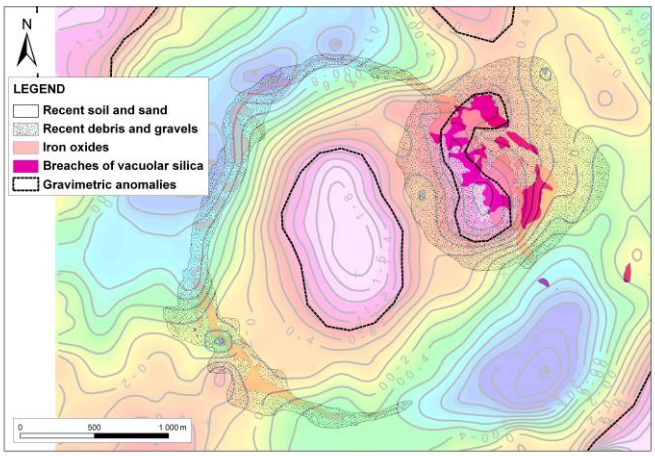
Spectrometric anomaly of Lamlaga

Landsat image of Lamlaga Structure

A representative sampling has interested all geological formations of Lamlaga structure.
The result of 150 rock samples shows a grade that varies between: 0.2 to 0.8% Nb_2O_5 ; 0.5 to 1.5% ΣREE ; 50% to 60% Total iron and indicial grade of gold of about 0.1 to 0.3 ppm Au.
A ground magnetic and gravimetric survey was done in this area and has confirmed the importance and the continuity in depth of the mineralised structure.

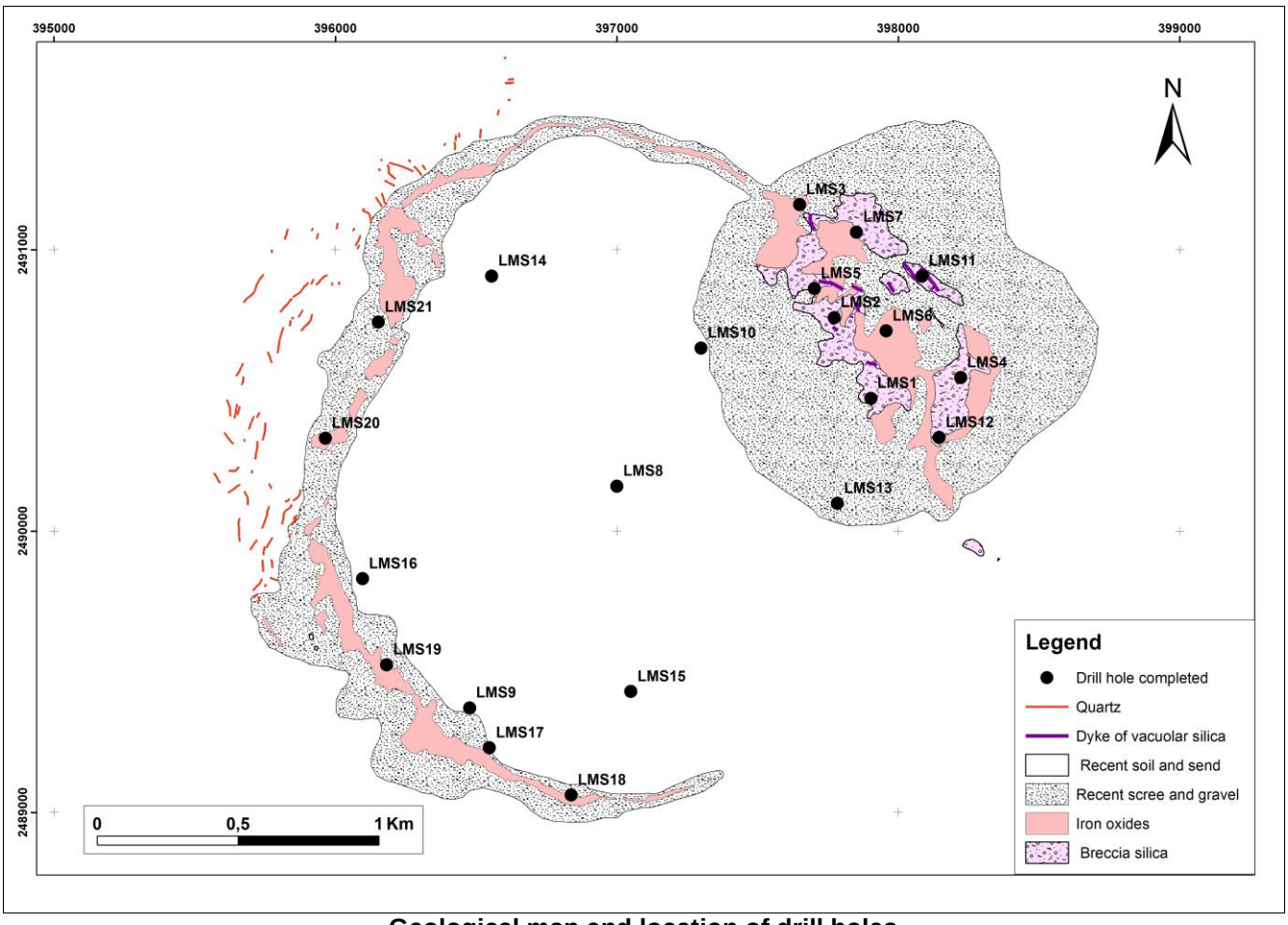


Magnetic ground survey



Gravimetric ground survey

Four campaigns of drill holes totaling 3735 m were undertaken to explore this prospect. All these campaigns have crossed the searched structures.



Geological map and location of drill holes

The results of chemical analyzes of core samples are summarized in the following table:

Drill hole	Thikness (m)	ΣREE (%)	Nb_2O_5 (%)	U_3O_8 (ppm)	V_2O_5 (%)	MoS_2 (%)
LMS1	27	0.73	0.34	126	0.16	
	and					
	122	0.58	0.29	346	0.09	
LMS2	31.3	0.96	0.89	156	0.44	
	and					
	92.1	0.85	0.45	346	0.27	
LMS3	6.9	0.12	0.03	48	0.73	
	and					
	60.5	0.22	0.04	346	0.29	
LMS4	28	0.66	0.08	143		
	and					
	59.4	1.59	0.34	346		
LMS5	176.9	0.59	0.22	134		
	With					
	26	1.90	0.30	376		
LMS6	211.5	0.62	0.28	108		
	With					
	10	0.77	0.33	169		
LMS7	106.8	0.47	0.29	82		
	With					
	7.7	0.96	0.67	171		
LMS8	149.5	0.51	0.41	139		
	With					
	78.2	0.71	0.60	185		
LMS9	60	1.23	0.10	54		0.10
LMS10	30	0.80	0.46			
LMS11	52	0.56	0.38			
	With					
	5.6	1.05	0.70			
LMS12	20	0.80	0.17			
LMS13	37	1.10	0.26			
	With					
	13	1.56	0.70			
LMS14	71	0.47	0.26			
	With					
	47	1.07	0.32			
LMS15	24	0.46	0.44			
LMS16	99	0.73	0.23			0.02
	With					
	36	1.08	0.40			0.04
LMS17	98	1.18	0.21			0.04
LMS18	104.7	1.91	0.10			0.03
LMS19	67.6	0.43	0.07			0.01
LMS20	20.5	0.15	0.03			0.01
LMS21	23.5	0.13	0.08			0.03

A resource estimates, taking into account all the results, shows a potential of at about 618 million tons at 0.64% REE and 0.28% Nb_2O_5, however, we can define an area (zone 3) with resources of approximately 46 million tons with 0.95% REE, 0.12% Nb_2O_5.

The drill holes LMS9, LMS16, and LMS17 LMS18, made on the peripheral ring, show a molybdenum mineralization with grades ranging between 100 and 1000 ppm MoO_2, with a thickness of 20 to 100 m, and local grade of gold up to 2.7 ppm on metrical thickness.

	Average						
Zone	Thickness (m)	Resource (MT)	REE (%)	Nb2O5 (%)	MoS2 (%)	Zn (%)	V2O5 (%)
1	124	373	0,59	0,25	0,01	0,10	0,11
2	106,9	81	0,63	0,52	0,02	0,15	0,13
3	127,7	46	0,95	0,12	0,03	0,05	0,14
4	152,1	118	0,69	0,25	0,02	0,14	0,18
Total		**618**	**0,64**	**0,28**	**0,02**	**0,11**	**0,13**

PERSPECTIVES

The perspectives and the potentialities of the sector are important by:

- The dimensions of outcropping facies of the structure;
- Continuity of the Lamlaga prospect under the intermediate depression (drill hole n° 8 crossed over 100 m of siliceous breccia under the recent cover)
- The existence of other geophysical anomalies in the immediate vicinity of the annular structure of Lamlaga.
- The presence of Mo and Au mineralization on the peripherical ring.

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