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GEOMAGNETIC ANOMALIES REGISTERED IN THE IBERIAN PENINSULA BEFORE A TIME PERIOD OF INTENSE SEISMIC ACTIVITY

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Introduction

In the early morning of February 28 in 1969, a seismic crisis began with epicenters located in the SW of Cabo de São Vicente (Portugal). In a time interval less than three hours, five earthquakes of magnitude 8.0, 5.6, 3.9, 4.4 and 3.8 were registered by seismic stations. In that day, a total of 32 seismic events occurring in the region were registered by seismic observatories. Some answers to surveys carried out after the earthquake of February 28 include descriptions of phenomena that may be associated with changes in the terrestrial magnetic field. In this work, the magnetic field records (average hourly values) measured, 51 years ago, at the Observatories of Coimbra, Toledo, San Fernando and Almeria, in the Iberian Peninsula and Tenerife in the Canary Islands, are studied. Although there were time intervals without measurements at the Observatories of Coimbra, San Fernando and Tenerife, it was possible to establish relationships between the different records and to relate temporally some of the anomalies found with seismic activity detected in the SW of Cape St. Vincent, Morocco Sea and Gorringe region.

Material and Methods

Data used were taken from the Annals of Geomagnetic Data of Magnetic Observatories of Almeria, Coimbra, Tenerife, Toledo and San Fernando, in the form of average hourly values, with daily average values and monthly mean values of magnetic declination, horizontal field and vertical field. Values provided by the IGRF2020 Model were also used. Average daily values obtained in time intervals including the registration of one earthquake occurrence were analyzed. Average hourly values were also used to obtain a more detailed analysis of the magnetic field near the earthquake occurrence. Five earthquakes registered from August 1968 to November 1969 were analyzed.

Location of Magnetic Observatories whose data were used

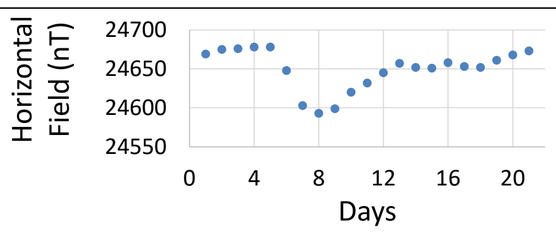
Observatory	Latitude N	Longitude W
Almeria	36.853	2.460
Coimbra	40.222	8.422
Tenerife	28.477	16.277
Toledo	39.874	4.047
San Fernando	36.667	5.945

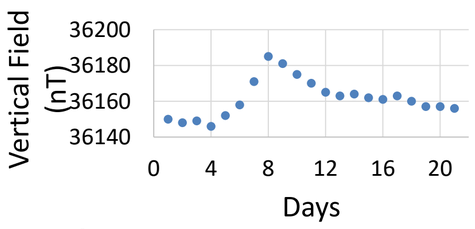
Results

Average daily values

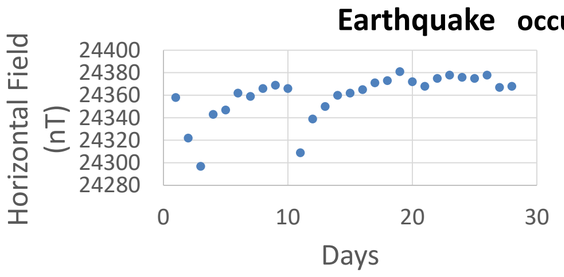
Earthquake occurrence : October 30th and November 7 th,1968

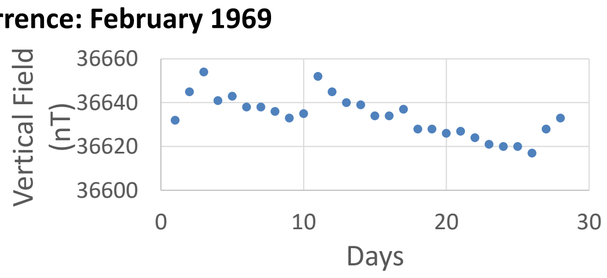
The horizontal fied increase until October 29th. The earthquake occurred on October 30th (day 6) during the descent of the field. From November 2nd to November 6th the horizontal field increases and the earthquake occurs on November 7th (day 14).





Earthquake occurrence: February 1969





An increase of the vertical field occurred on October 29th (day 5) when the horizontal field shows the maximum value. The decrease of the vertical field observed on November 6 th (day 139 is lower than expected from the descent of the inclination and the increase of the horizontal componen.

Earthquake occurrence: August 31st, 1968

A decrease of the vertical field was observed in August 30th when the horizontal field shows a decrease (the maximum value occurred on August 28th). A great increase of the vertical field was observed on August 31th.

Earthquake occurrence: February 10th and February 28th, 1969.

Strong perturbations of the geomagnetic field in Coimbra can be seen on February 3rd and February 11th. No earthquakes were registered in February 3rd or 4th. High values of the horizontal field occurred from day 6th to day 10th and from day 16th to day 28th. The lowest value of the vertical field was obtained on day 26th. No increase was observed on days 27th and 28th.

Average hourly values

The vertical component of the field in August 31st 1968 shows an increase (8 nT) that remains equal for 4 hours in Toledo and 2 hours in Tenerife (0 nT). The intensity of the field is lower than the average monthly values for the hours studied . The inclination is higher than the average value and its variation seems to be related to the variation of the horizontal field.

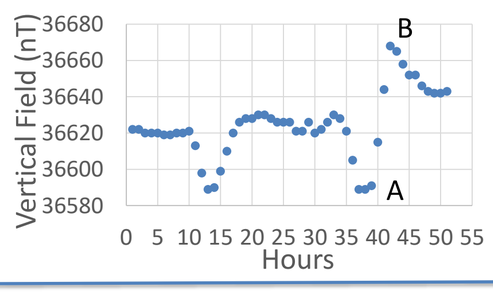
The vertical component of the field on October 30th 1068 in Toledo shows na increase (14 nT) that remains equal for 3 hours. The inclination is higher than the average value and its variation seems to be related to the variation of the horizontal field.

On November 7th data from the Observatories of Toledo and Tenerife shows na increase in the horizontal and vertical componentes and in the intensity of the field at the hour of th earthquake.

Magnetic Field deviations from the average value (nT), associated with the earthquake occurrence on February 10th 1969 in the Cadis Gulf.

Observatory	Horizontal Field 18-19; 19-20; 20-21	Vertical Field 18-19; 19-20; 20-21	Field Intensity (nT)
Coimbra	20; 22; 20	-3; -4; -3	9
Toledo	13; 13; 13	-4; -6; -5	3
San Fernando	11; 11; 11	1; 0, 0	7

Coimbra vertical field in February 27th . Differences between the maximum (B) and the minimum (A) values registered in the Observatories studied.



Observatory	B-A (nT)
Almeria	57
Coimbra	79
San Fernando	67
Toledo	63
Tenerife	44

Discussions & Conclusions

Strong variations of the geomagnetic field including a decrease of the horizontal component were recorded at the beginning of February 1969 (day 3 and day 11) that may be related with descriptions made in the surveys of March 1969. Strong and fast alterations were also registered in the afternoon of February 27th.

The magnetic anomalies recorded in the time intervals associated with the occurrence of five earthquakes from August 1968 to February 1969 shows **an increase of the horizontal component** (average daily values) **followed by a decrease** that can occur during a few days. The increase of the vertical component may occur before or after the initial reduction of the horizontal component but **the earthquake only occurs during the increase of the vertical field**. The location of the February 10th earthquake relative to the Observatories used in the work made possible to detect **alterations occurring at intervals of 2 or 3 hours (including the hour of the earthquake occurrence).** The values obtained seems to be related with the longitudinal distance between the site of the earthquake epicenter and the observatories.

From February 14th until February 26th the horizontal field showed high values with small variations (not more than 20 nT). From the day 22 to the day 26, the horizontal field shows the same value. The vertical field shows a decrease from the 14th until 26th. On the 27th, there was an increase in the vertical field and the earthquake occurs in February 28th.

Acknowledgements

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