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MINERAL HORIZONS, ELECTROMAGNETIC FIELDS AND CIRCULAR SHAPES IN THE GRASS

HORIZONS MINÉRAUX, CHAMPS ÉLECTROMAGNÉTIQUES ET FORMES CIRCULAIRES DANS L'HERBE

ORIZZONTI MINERALI, CAMPI ELETTROMAGNETICI E FORME CIRCOLARI NELL'ERBA

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Abstract

The occasional appearance of circular shapes in meadows and farmland located on slopes usually affected by gravitational phenomena, offered an occasion for verifying the possible relation between the position of the circles in the grass, the gravitational movement of the slope affecting its mineral horizons and the variations of electric and static magnetic fields close to the circular shapes and in the surrounding area. The stress caused by the "creeping" movement in the uderlying ground turned out to be in direct relation with the variation in the electric and magnetic fields caused by piezoelectric and piezomagnetic minerals such as quartz. The onset of the electromagnetic process involves the conversion of electric energy on the surface into an area of spherical shape which is linked with a different growth of herbaceous species compared to the surrounding vegetation.
Key words: mineral horizons; electromagnetic fields; solifluction; soil creep; circles in grass; piezoelectricity.

Résumé

La sporadique apparition de formes circulaires dans des prés et des terrains cultivés le long de pentes en général exposées aux phénomènes de gravitation, nous a donné l'occasion de vérifier expérimentalement l'éventualité d'une relation entre la position des cercles dans l'herbe, le mouvement gravitationel du versant concernant les horizons minéraux et les variations de champ électrique et magnétique statiques près des formes circulaires et dans le territoire environnant. La tension induite par le mouvement "rampant" dans le sol sous-jacent s'est révélée en relation directe avec la variation du champ électrique et magnétique causée par la déformation de minéraux piézo-électriques et piézo-magnétiques comme le quartz. L'apparition du phénomène électromagnétique entraîne la conversion de l'énergie électrique qui se manifeste à la surface comme un espace de forme sphérique caractérisé par une croissance de l'herbe différente de celle du reste de la végétation.
Mots-clés: horizons minéraux; champs électromagnétiques; solifluxion; soil creep; cercles dans l'herbe; piézo-électricité.

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Riassunto

La sporadica comparsa di forme circolari in prati e in terreni agricoli situati lungo pendii, generalmente interessati da fenomeni gravitativi, ha costituito l'occasione per verificare, dal punto di vista strumentale, la eventuale relazione fra la posizione dei cerchi nell'erba, il movimento gravitativo del versante che coinvolge gli orizzonti minerali, le variazioni di campo elettrico e magnetico statico in prossimità delle forme circolari e nella zona circostante. Lo stress indotto dal movimento "strisciante" nel suolo sottostante è risultato essere in diretta relazione con la variazione del campo elettrico e magnetico, prodotto dalla deformazione di minerali piezoelettrici e piezomagnetici, come ad esempio il quarzo. La generazione del processo elettromagnetico comporta la conversione di energia elettrica che si manifesta in superficie, in un spazio di forma sferica, che si caratterizza dal resto della vegetazione per una diversa crescita delle specie erbacee.

Parole chiave: orizzonti minerali; campi elettromagnetici; soliflusso; soil creep; cerchi nell'erba; piezoelettricità.

Introduction

The research on the dynamic processes of slopes caused by force of gravity has offered indications about the stability of slopes in well defined hilly and mountainous areas. The analysis of the surface elements, which "mirror" dynamics in the detrital blanket below, reveals that small changes in the slope equilibrium have occurred, as well as incipient evolutions of gravitational movements. Generally speaking, they are slow, partial movements of the soil originating curvatures in the surface which depend on the slope gradient. It is a real creeping movement of the detrital blanket which can be affected by gravity but also by other factors, such as the circulation of water or thermal expansion or shrinkage according to the season. What matters from a dynamic point of view is the variability of such processes in time, with reference to the speed and intensity of the gravitational process.

Actually this is a normal, natural, in a sense continuous subsidence process of the detrital blanket that covers the slopes and tends to slip downwards. The grass blanket might not break and reveal distortions, such as the circular shapes that appear in the meadows searched in the area where investigations were made.

However this research concentrated on the analysis of the movements that occur below the ground surface which, at times, generate stress in the minerals, and not on the slow movements of solifluction and soil creep which cause crinkles on the surface. Fragments of quartz (or of other minerals) originating from meteoric degradation or the presence of arenaceous rocks can generate electromagnetic energy through the piezoelectric process when they are compressed or under stress (see: Bishop, 1981; Finkelstein, Hill & Powel, 1973; Teodorani, 2004). When there are slope movements, the flows of the materials underneath intensify in some areas and "spread out" in others. Where there is greater tension, therefore, piezoelectric

minerals are subject to pressures that can generate charged clouds propagating upwards to the surface. The same process has been studied on a greater scale to verify relations existing between tectonic stress and seisms, the appearance of anomalous light phenomena in the atmosphere and the creation of electromagnetic fields (see: Straser, 2007, Balbachan & Parkhomenko, 1983; Brady & Rowell, 1986; Derr, 1986; Freund, 2002; Wessel-Berg, 2004; Derr & Persinger, 1990; St-Laurent, Derr& Freund, 2006; and others).
The production of electromagnetic energy and its concentration in well-defined areas of the atmosphere, usually a few metres from the soil, have sometimes been connected with the circular shapes that appear in cereal crops fields (Levengood & Talbott, 1999). Concern for these circular shapes goes back to the early 1980s and refers to oats fields along grassy, steep slopes near Bratton, England (Meaden, 1991).

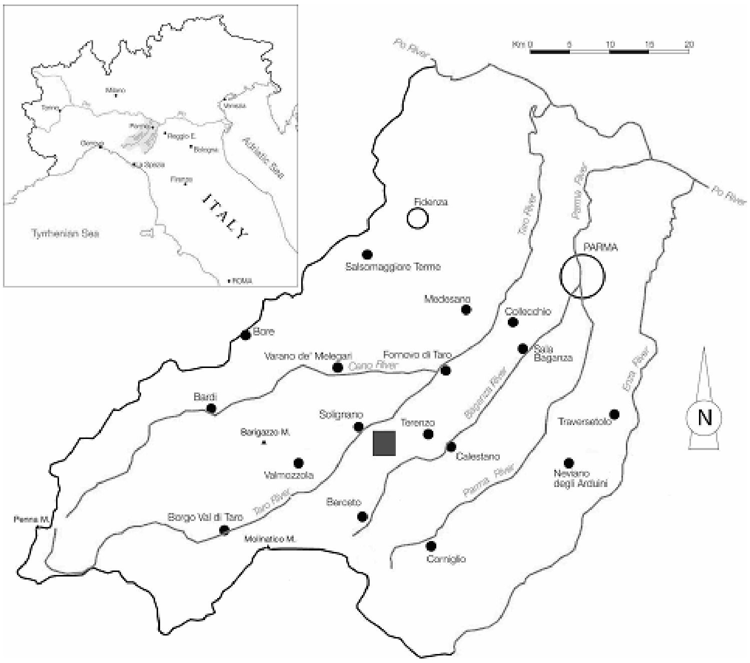

Figure 1

Index map

If we accept the hypothesis that "balls of light" can radiate energy upon the earth surface and create geometrical shapes, usually circular ones, even though not always perfect, then it is reasonable to think that dot-like concentrations of static electromagnetic energy generated underground can cast similar circular shapes onto the surface. In this research the circulation of underground waters, which might influence the amplification of the electric charges and thus affect the growth of vegetal species (Levengood, 1994), has not been taken into consideration.
The area investigated (44°36'34"N, 10°00'52"E) is a field lucerne *(Medicago sativa*) crop under rotation, located near Selva Grossa, in the province of Parma (Fig. 1).

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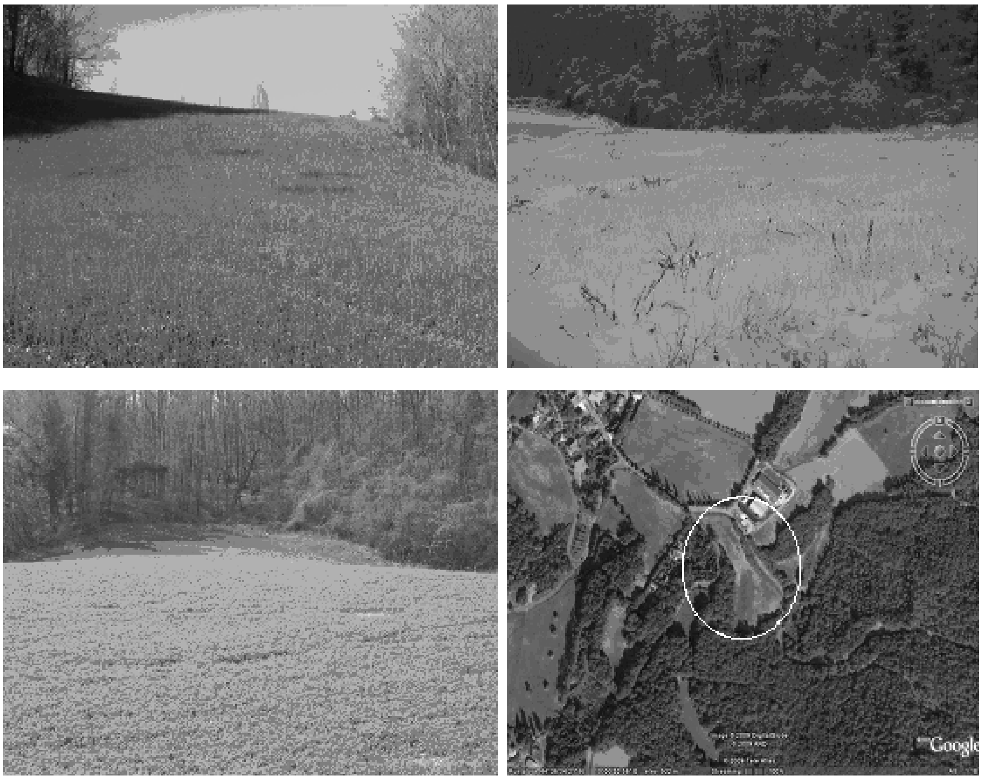
The area, which geologically belongs to the Solignano Flysch composed of arenaceous-clayey sequences with regular intercalations of marly-calcareous beds in the mid-lower part (Zanzucchi, 1980), is also affected by mild seismicity and by the occasional appearance of anomalous phenomena in the atmosphere (Straser, 2007; Straser & Kokus, 2008). The field, which covers an area of about one hectare, is on sloping ground with a gradient above 5%; the lower part is crossed by the road linking Strada di Fondovalle Taro and Strada Statale della Cisa. Various circular shapes (about fifteen) varying in diameter from 70-80 cm to about 3 m, which have also been surveyed by the satellite (Fig. 2), are visible in the field in autumn, winter and spring. The circular shapes are in larger number in the steepest stretches; in the lower part of the field there is a landslip affecting the road practicability.

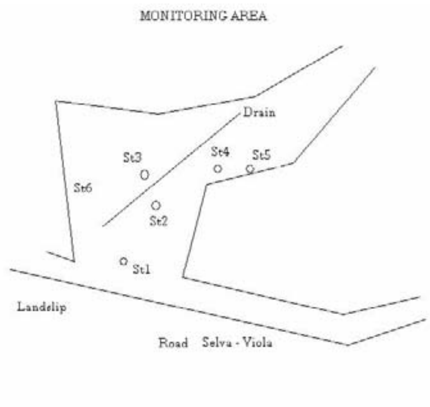
Figure 2 - *The area investigated photographed in autumn, winter and spring and from a bird's eye view (circled in white).*



<u>Materials and methods</u>

The research has been carried out with instrumental seasonal mesurements to survey the values of static electric and magnetic field in the grass circles and surrounding areas. Measurements were taken by means of a multifield static gauge model ESM-390, to display the variations of natural magnetic and electric fields. Fig. 3)

Figura 3 - *The portable instrument has the following technical specifications:*
Viewer: analog Magnetic scale range: from 0 to 50 kHz - from 0 to 100 uT
Electric scale range: from 0 to 50 kHz – from 0 to 1000V/m
Radiofrequency scale range: from 0.01mW/cm² to 1mW/cm² – from 100 kHz to 2.5 Ghz
Operational temperature: 0°C to +50°C.



Results

The readings were registered in fall (2008), winter and spring 2009 (Tab.1), when the circles are visible and easily distinguishable from one another amid the vegetation, as they are brown in colour. In both circumstances the frequency was almost the same, whereas the value of the static electric field measured outside the meadow was always higher than inside the circles.

Discussion and conclusion

The measurements taken on the ground revealed a higher value of the electric field in the areas outside the meadow when compared to the values measured inside the circles in the grass: the instrumental value in the different stations is usually constant.
The static magnetic field, however, was higher or just the same when measured outside the meadow and near the landslip or inside the circles. Microwave frequency was virtually the same both outside the meadow and inside the circles, with one exception, when intermittent pulsation was recorded. The swing had been measured on the day (14 April 2009) previous to a minor seismic event with epicentral area located about 10 km away from the research area (Tab. 2).

Table 1 - *List of the readings measured in fall 2008, winter and spring 2009*

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Date	15.11.08			10.01.09			09.04.09		
Place Selva Grossa	Magnetic field	Electric field	Frequency	Magnetic field	Electric field	Frequency	Magnetic field	Electric field	Frequency
	uT	V/m	mW/cm^2	uT	V/m	mW/cm^2	uT	V/m	mW/cm^2
Staz. 1	1	5	0,01	0,8	8	0,01	0,2	2-8	0,01-0,1
Staz. 2	0,5	5	0,01	0,2	5	0,01	0,1-0,5	2	0,01
Staz. 3	0.3	2 – 10*	0,01	0,2	5	0,01	0.2	2	0,01
Staz. 4	0,2 –1*	2 – 10*	0,01	0.3	5	0,01	0.2	2	0,01
Staz. 5	0,2	2 – 10*	0,01	0,2	5	0,01	0.2	2	0,01
Staz. 6	0,2	2 – 10*	0,01	0,2	5	0,01	0.2	2	0,01

(*)indicates the pulsations swinging around the two values measured in less than 10 seconds. The maximum diameter of the circle (no. 2) is about 3 metres (see photo)

Table 2 - *Data about the earthquake linked with the emission of microwaves recorded in the area investigated*

Date-time	Magnitude	Coordinates	Depth	Epicentral area: municipalities affected within 10 Km
16.04.2009 at 01.11.51 (in Italy) 15.04.2009 at 23.11.52 (UTC)	2.7	44.59°N, 10.12.4°E	5.9 km	CALESTANO (PR) TERENZO (PR)

This last fact is of relevant scientific interest since it could reveal that coincidence may exist between the stress produced in rocks and seismicity; however it is not analysed in the present research. To complement the measurements taken, also lab experiments were carried out to check whether analogies might exist among the values of the static magnetic and electric field generated when pressures are exerted on the soil. Ground samples (about 3,000 cm^3) were collected near the research area and pressures varying from 20 to 120 bars were applied. Each increase in pressure coincided with a rise of the static magnetic and electric field, measured with the same multifield instrument used in the open air and set one metre away from the hydraulic press.
The results of the lab experiments confirmed that higher values of static magnetc and electric field correspond to higher pressure affecting the mineral horizons. If we transfer lab data into practice, we can notice that in the area where the minerals are under higher pressure, the values of the electric and magnetic fields are usually higher than inside the circles in grass. The phenomenon seems to be due to the evolution of natural events and influenced by both the electromagnetic field and the geophysics of the place. According to the model here conjectured, we can conclude that circular areas in the grass reflect conditions of stress in the ground. The lower

values of electric and magnetic field in comparison to the external areas may indicate that there is lighter pressure on the mineral horizons. Pressure affects the stress on piezoelectric minerals, therefore also the production of static magnetic and electric fields which, in turn, may affect the different growth of vegetation. Similarly to what happens for Balls Of Light located a few metres above the ground and assumed to be able to generate circular shapes in cereal crops, the appearance of circles in grass crops may be caused by an electric and magnetic underground source within a depth of a few metres. The projection of the electromagnetic lines goes upwards instead of propagating downwards to the surface (Fig. 4). The method could be applied in areas of hydrogeological hazard, both for the identification of dangers caused by gravitational movements along a slope and for the location of the areas with greater flow of particles through the different horizons, especially mineral ones. The method can also be useful for the assessment of areas affected by gravitational movements, especially in farmland, by spotting the presence of circular shapes in the grass and recording peculiar values of electric and magnetic fields.

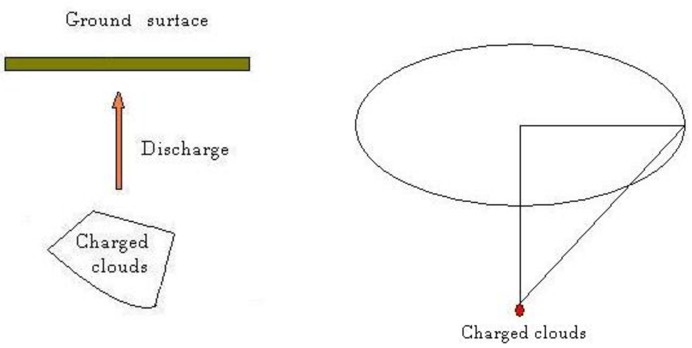

Figure 4

A model for the interpretation of the generation of circles in the grass

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