THE GENERATION OF ELECTRIC FIELDS DUE TO THE CRATER FORMATION

Adushkin V.V. & Soloviev S.P.
Schmidt Institute of the Physics of the Earth, USSR Academy of Science

It is well known that formation of impact and explosive craters is accompanied by the electric and the magnetic phenomena which are simultaneously with the mechanical effect. The transient magnetic field were experimentally studied during hypervelocity impacts into hard targets [1,2].

A series of experiments have been made when craters of sm to dekameter scale have been formed by detonation of high explosive near the ground surface and the low-frequency electric fields have been measured. Here we report the results of experiments and their extrapolation to the larger scale. The variation of the vertical component of the potential gradient E_z of the electric field has been measured in the air by field mills which were installed on the surface of the ground. The variation of E_z ($\Delta E_z(t)$) are standed out against natural background of the electric field which ranged from 120 to 150 V/m.

The low-frequency electric field generated by explosion is a complex phenomenon which depends on material properties of the soil, humidity, content of dust particles and their size distribution. As a rule, $\Delta E_z(t)$ has the bipolar waveform when the soil humidity ranges from 5 to 15 % (fig.1,curve a). The amplitude of $\Delta E_z(t)$ depends on amount of the explosive and distance R to the point of measurements. The form of $\Delta E_z(t)$ changes if the value of soil humidity is small enough and content of dust particles in the soil is significant (fig.1,curve b). The possible mechanism of electric field generation is connected with the electrization of the soil particles and the separation of electric charges between the ionized cloud of the detonation products and soil particles during the filtering of the ionized products of the detonation through the destroyed soil. Under these conditions, negative electric charges are accumulated on the soil particles while the positive ones, on the product of detonation [3,4].

The value of electric charge Q of the ionize dust cloud, which was generated during the crater formation, can be determined from the empiric relation:

$$Q = k * D^{2.0\pm0.1},$$

where Q in Coulomb, D in meters, $k = 7.2*10^{-4}$. D is the diameter of the crater formed by explosion on the surface of the ground.

The considered above mechanism of the generation of the electric field seems to be valid in the case of the meteorite crater formation. If a planet has an atmosphere then electric phenomena may be induced with the same mechanism.The estimation of value of the electric charge Q generated by the formation of the crater with diameter of 1 to 100 km has been made on the base of above empiric relation (fig. 2). The approximate value of the electric charge is equal to $7.5*10^4$ C for crater of 10 km. However, it can be shown that such electric charge of ionized dust cloud is never attained because of the lightning discharge. It should be noted that the electric charge of the thundercloud typically has a value about 300 C. Radio wave emissions produced during the lightning discharges have the wide frequency range (the spectral maximum of this emission belongs to the

frequency range about 5 to 10 kHz). The lightnings may contribute to the formation of ozone and NO in the atmosphere gas that can be followed by the acid rains and other phenomena effecting the environment.

In the case of the planet without an atmosphere the generation of the electric field may be used for the remote identification of the meteorite impact events.

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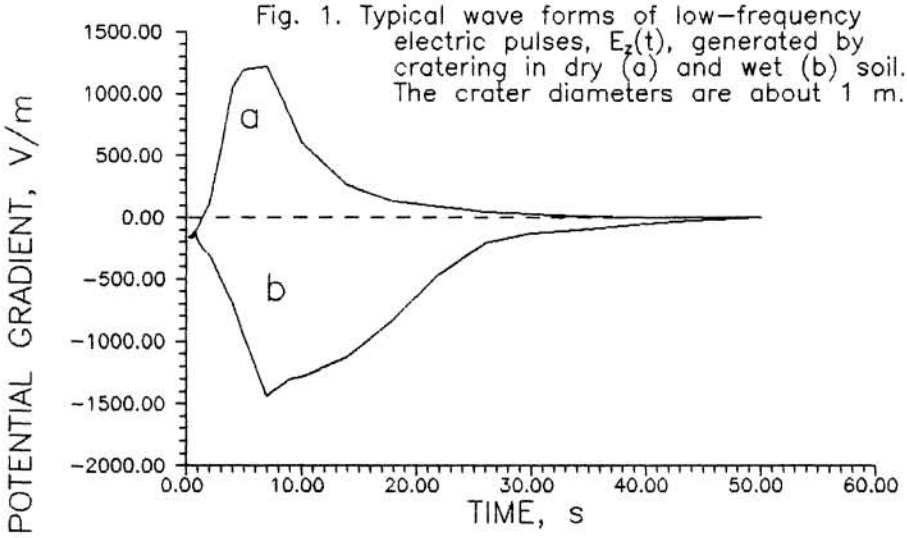

Fig. 1. Typical wave forms of low-frequency electric pulses, $E_z(t)$, generated by cratering in dry (a) and wet (b) soil. The crater diameters are about 1 m.

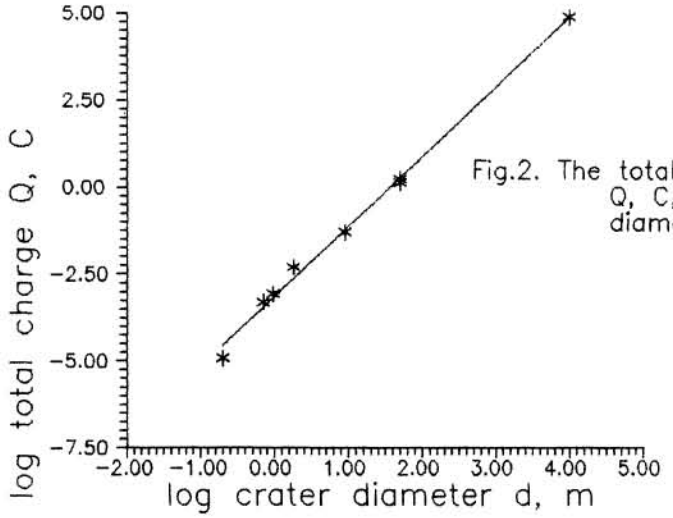

Fig.2. The total charge Q, C,v.s. crater diameter d, m.