FULGURITE AT THE MEZARGEDİĞİ AREA İZMİR-SELÇUK-ÇAMLIK VILLAGE, TURKEY

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ABSTRACT.— Fulgurite in the Çamlık Region is a black silica glass with the white spherulitic inclusions. Those feldspar-like inclusions are lath shaped grains and composed of nonreactive SiO_2-modifications such as tridymite, cristobalite, lechatelierite, coesite, and quartz. The silica glass is the melting product of a high quartz bearing silicate rock and quartzose sand. In the area the origional materials are quartz veinlets bearing muscovite schist and quartzose sand used in concrete base fastening the power-line pole. Persistent melting of the mother-lode has increased the amount of the melt. Hence flow of the liquid material has taken place for a while within few meters. Because of the flow migration from the generating environment the produced silica glass has spreaded out around and scattered within 25 square meters. Solid product shows hollow tubes along the flow channels. The steam and reaction gases have given vesicular cavities in the solidified front. These vesicular structures have given a spongy structure to the solid glassy mass. The white angular granules in the black glassy matrix have been identified as the SiO_2-modifications of the quartz in thin sections under the microscope.

INTRODUCTION

A press news informed that after lightning upon an area around Çamlık village petroleum has been found (Bulvar Jan. 14th, Hürriyet Jan. 16th, Yeni Asır Jan. 25th). This press information has remined us about the probability of the fulgurite formation. The occurance has been checked in the field and studied macroscopically and microscopically.

The obsidian-like silica glass has been formed at the foot of a high power-line pole. It is an accumulation of a silisified rock melt that shows flow structure. The mode of formation is not as it has been commended but because of the electric arc from the power-line released from the isolation porcelain pot on top of the iron pole (Fig. 1). The electric current has passed through the iron-pole to the ground, and during this current jump an arc has been sreated at the contact with the ground. The tremendous heat of this arc has melted quartz and quartz bearing muscovite schist and given silica glass; fulgurite.

GENERAL GEOLOGY

The stratigraphic succession starts with the muscovite schist which has been enveloping the augen gneiss nucleus. These metamorphic units belong to the Menderes Massif of the Western Anatolia. Marble and crystallized limestone follow up. Serpentinites in the succession are emplaced tectonically. Then Neogene elastics, clays and marls, and marly limestones cover some depresions. Pliocene terraces and quaternary alluvial deposits are the latest placers (Fig. 3).

The stratigraphic unit in the fulgurite bearing location is muscovite schist. The mineral constituents are muscovite, quartz, feldspars (especially Na-plagioclases), and chlorite. Opaque minerals are the iron oxide constituents. They are accessery minerals.

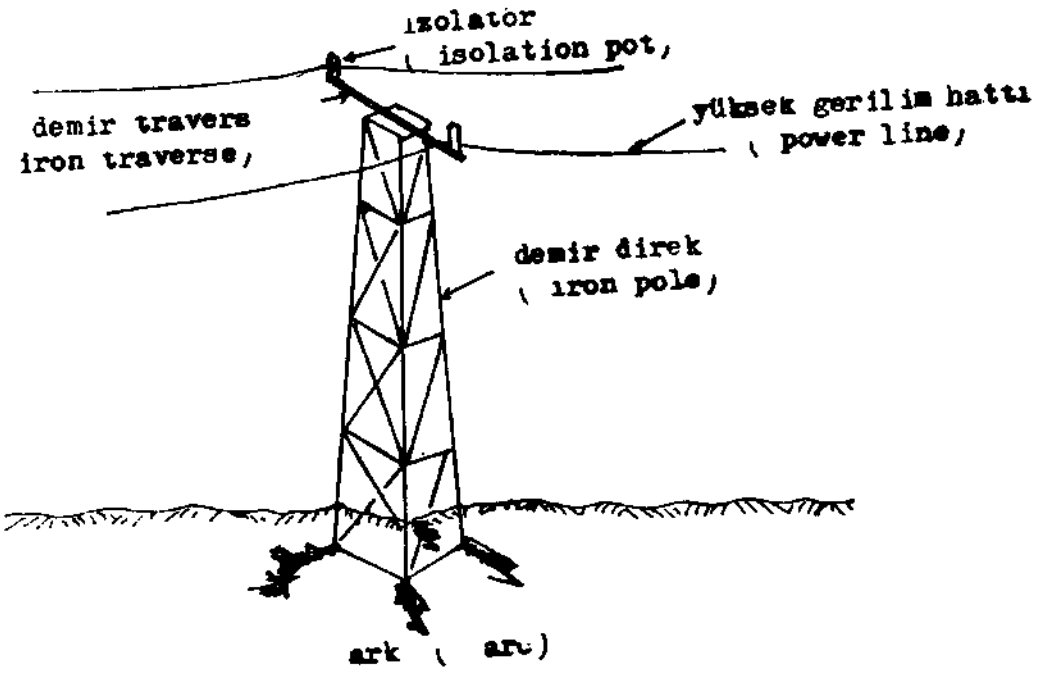

Fig. 1 - Current flow to the ground through the iron pole, and formation of the arc-light.

Faulting is the main tectonic unit in the area (Fig. 3). Structural appearance have been shaped by the block movement in trusts and gravity faults. The East-West and/or near-by striking lineations are the basic features. Those lineations mark the characteristic direction of the Alpine tectonic units.

Fold structures are very poor and they are the results of trusting and gravity faults. Plastic flow structures seem to be drag folds.

FULGURITE AND ITS MODE OF FORMATION

The generated glassy material formed at the base of a high voltage power-line pole shows flow structure. The pole is made up of iron, and hence it is a conductive body, Photo 1. Silica glass has been spreaded out within 25 square meters. From the four feet of the iron-pole the melt radially flows out (Fig. 1) and (Photo 1). Along the flow channels hollow tubes of the glassy material have been formed Photo 2. The diameter of the tubes have been changing up to 20 centimeters. At the exposed extend of those tubes the flowing melt accumulated and this liquid mass has traveled for a while and solidified Photo 1. The exposed surface of the glassy mass shows spongy structure due to the vesicular cavities.

The glassy mass is in brillant black colour at the surface. When the hollow tubular pipes are examined in section one can see the inside face has been glazed and shows a pearly appearance. It is dark gray in colour. Behind the glaze there is a porous zone having a spongy structure. The thickness of this zone is few centimeters. It is gray in colour, and consists of angular grains in glassy matrix. Those grains are similar, in appearance, to feldspars and are presenting a gosh structure. But in spite of these similarities in appearance and structures the microscopic identification presents spherulite

composition having SiO_2-modifications such as tridymite, cristobalite, coesite, lechatelierite, and quartz.

The second zone in section shows obsidian-like lithology. It is dense and compact, and fracturing conchoidally.

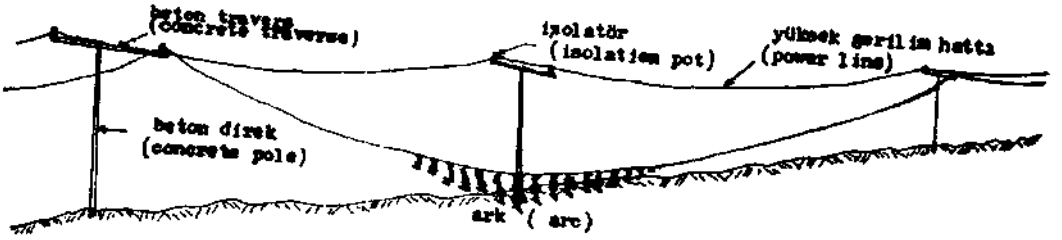

Fig. 2 - Current jump to the ground, and formation of the arc-light.

The third zone is gray in colour and has feldspars-like white spherulite grains. The vesicular cavities in this layer are small, and due to this vesicularity there is a spongy structure.

The outer surface of those tubular pipes carries the rock fragments and chips of the muscovite schist and concrete materials.

The obsidian-like dense rock has a moderate specific gravity, but specimens having spongy structure are quite light. The specific gravity of the rock changes from 1.75 to 2.75 gr/cm^3.

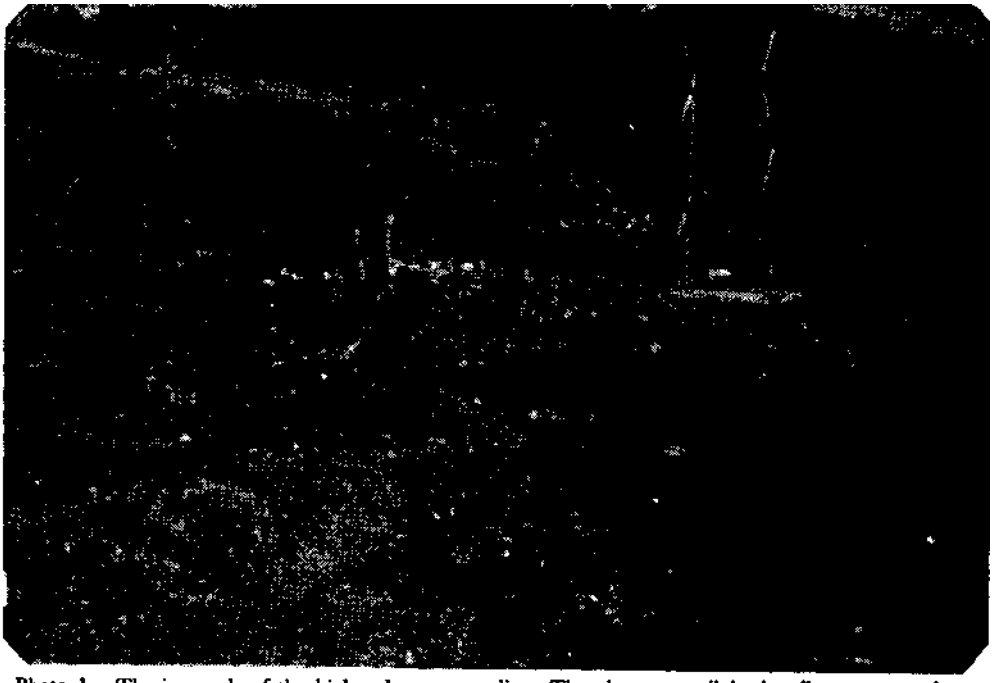

Photo 1 - The iron pole of the high voltage power-line. The glassy materil having flow structure has been formed at the four feet and is radially lining out to the surface.

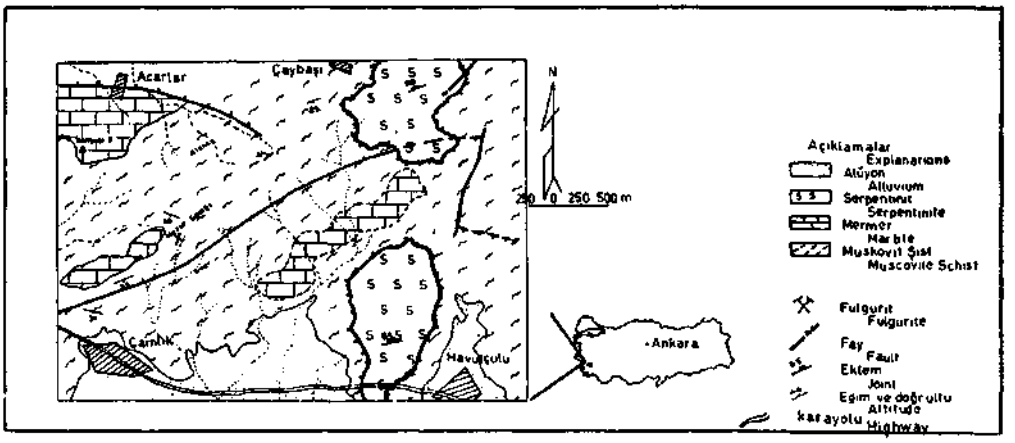

Fig. 3 - Geology of the Çamlık Region.

THE PROCESS CREATED THE FULGURITE

The formation of the fulgurite has taken place at the base of a high voltage power-line pole, Fig. 1. It is an iron pole, hence conductive. The energy has been taken from the high voltage power-line through the iron pole. The releasing of the power-line from the isolation pot on top of the pole yielded a connection with the conductive iron pole. The electric current flowing into the ground through the pole has created an arc at the feet, Fig. 1. The tremendous heat of this arc has melted the quartz muscovite and quartzose sand of the concrete basement. This liquidified melt has flowed through the channels and formed the hollow tubular fulgurite, Photo 2. The heat generation from the arc is more or less same as it has been in Plasma Technique in metal extraction in this method the heat may be maintained up to 16 000°C. The persistency of the heat has caused the increase of the melt in amount by feeding of a continuous melting. The melt which comes out in this way has flowed for a while and solidified in a distance. The reason of the change of the state is not a lightning action as it has been recommended by some scientists and peasants. If it would be formed due to a lightning action the fulgurite formation would show a line segment or a point location. On the contrary here it shows a migration and flow structure. The lightning action may create only an in situ product, and the amount of the melt can not be as much as in this particular case. The same formation has been studied in the North of Yozgat in 1974. In this area, too, the silica glass was identified along a line segment between two high voltage power-line poles, Fig. 2. It was an in situ formation and explained in the same way.

CONCLUSION

The silica glass which is studied in the field has been formed by the electric arc. This arc has been produced by a high voltage power-line passing along the field. The realesing of the power-line from the isolation pot on top of the pole has been loosened the wire and it has come contact with the iron pole. The current has started to flow to the ground through the iron pole. At the foot of the pole the electric charge created an arc which may usually produce a heat with an extremely high temperature over 2000°C. This high temperature heat has melted the quartz sand and quartz bearing muscovite schist. This change of state has graded into fulgurite formation.

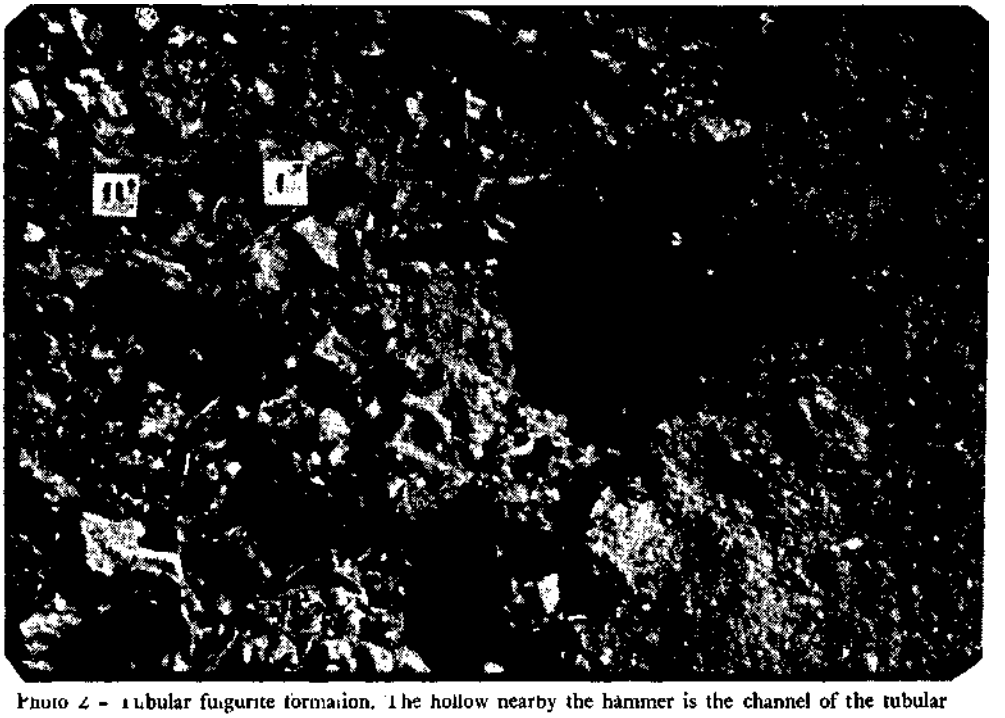

Photo 2 - Tubular fulgurite formation. The hollow nearby the hammer is the channel of the tubular pipe. f - glazed face of the tube; f1 - flow structure on the fulgurite.

Fulgurite, in Çamlık Region, has a black colour. It is pearly and shows conchoidal fracture. The vesicular structure is due to the reaction gases and steam generated from the ground water. The hollow tubular structures along the channels are remarkably formed. These tubular pipes have the diameters up to 20 centimeters.

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