energy in excess of about 1 eV (ref. 13) for its explanation. Clearly, these hydrogen atoms may come from the geomagnetic source suggested here, although an alternative has been suggested[14].

The theory is compatible with and constrained by sunspot minimum observations of geomagnetic plasma, red aurora, and electron densities in the polar cap F region, and night L_{α}. Although the four phenomena are consistent on an order of magnitude basis, the theory calls for better measurements of the parameters involved. There will be further tests of it when measurements appropriate to sunspot maximum conditions and geomagnetic quiet are available.

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Temperature Conditions of Salt Dome Intrusions

IN discussing the effect of temperature on salt dome intrusions, Dr. W. C. Gussow[1] quoted the example of salt domes in Iran, and implied not only that raised temperatures are necessary for inception of salt (halite) intrusion at depth, but that they must also be involved in the movement of salt glaciers at the surface.

Temperatures of the order required are well attested at depth by the kind of data quoted, and also by alteration of exotic blocks of igneous and other rocks in the salt in Iran, and by metasomatism and pneumatolytic action elsewhere, as in Arctic Canada[2,3]. O'Brien[4] believes movement to be begun by igneous intrusion, but this hypothesis has not been accepted as generally applicable[5,6]. Once large salt bodies have started moving, however, they remain mobile at shallow depths where temperatures are demonstrably far lower than the 200° C which Gussow regards as the limit for flow, and their movement can be traced by stratigraphical anomalies in the rocks through which they are forced. There is ample evidence of shallow movement of plugs during sedimentation, and of their occasional temporary emergence at the surface. Recent work has emphasized that the upper part of a plug is not intruded as an inert piston, but that it changes its shape in response to varying stresses while still moving through relatively shallow overburden[7].

The active surface salt plugs and salt glaciers of Iran, however, demonstrate most clearly that salt flow occurs at nearly normal temperatures. The climate of southern Iran is arid but nevertheless has a measurable rainfall, and there are numerous examples to show that if intrusion ceases the dome begins to dissolve, and eventually becomes a thickly detritus-cloaked mountain, or even an empty crater[6,8,9]. There has never been any doubt that salt mountains such as Kuh-i-Namak, near Bushire, owe their elevation (in that case 4,000 ft. above the adjacent plain level) to salt extrusion continuing to the present day. There is no thick mantle of detritus; the salt flanks are precipitous and salt avalanches are recorded. But this salt is not hot, nor is that of the salt glaciers, contrary to Gussow's implication. The glaciers are related to the modern topography and may show surface flow lines similar to those of ice glaciers. They demonstrably waste by solution so that (like melting ice tongues) they attenuate distally and terminate as thin salt layers sandwiched between "moraines" of insoluble matter. Solution, soil creep and rainwash as well as glacier movement are continually active in moving the salt and its clastic content downhill; it is only by the continuing feed from the active dome above that their precipitous unstable slopes are maintained. All this takes place at temperatures which in summer may reach 46° C, but which are unlikely to be significantly higher.

Whether solid flow or the development of shear planes is the dominant element in salt movement has not been established, but it is abundantly clear that movement does take place at the temperatures occurring both at shallow depths and at the surface in tropical climates.

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Possible Relationships between Continental and Oceanic Basalt and Kimberlite

BASALTIC rocks conform to two standard compositions—alkali-basalt or tholeiitic basalt. Both types of magma occur in continental as well as in oceanic areas[1], but tholeiitic basalts are much more abundant than alkali-basalts. For example, the volcanoes of Hawaii were shown to consist largely of tholeiitic basalts with only a very thin cap of alkali-basaltic rocks[1]. The same holds for the volcanic rocks of the Mid-Atlantic Ridge[2]. In continental areas, the amounts of alkali-basaltic rocks are likewise very small in comparison with tholeiitic rocks.

Most authors agree that the origin of basaltic magmas must be attributed to some process of differential melting of peridotitic rocks in the upper mantle. To reach the required temperature, convection currents in the mantle are invoked by several authors[3]. The origin of alkalic and tholeiitic basalts is controversial. Yoder and Tilley's experiments[4] indicate that at pressures of more than 19 kbars, corresponding to a depth of more than 60 km, crystallization of basaltic magma produces a "high-pressure" mineralogy, that is pyrope and omphacite instead of plagioclase and augite. Settling of garnet, observed in some of their experiments, would yield a residual liquid enriched in alkalis. At depths greater than 60 km, gravitational separation of pyrope crystals from a tholeiitic basalt magma might thus produce residual magmas of alkali-basaltic compositions. Similar ideas have been expressed by Evans[5] and Holmes and Harwood[6].

As a source of basaltic magmas, Yoder and Tilley suggest widespread occurrence of garnet peridotite in the upper mantle. A more likely hypothesis, in my opinion, has recently been put forward by De Roever[7], based on