continues, "it seems an extraordinary circumstance, and to me impossible to credit, that the nodules, the flakes and the implements should, notwithstanding the enormous rainfall . . . which ploughed out the side valleys opening on the Nile, be found lying, *even in a single instance*, in undisturbed association at the present day." The same criticism is passed upon the flint instruments also brought by Seton-Karr from Somaliland (of which the Liverpool Museum possesses a series), which have been described by Sir John Evans, before the Royal Society, as in form absolutely identical with some from the valley of the Somme and other places, and proving "the unity of race between the inhabitants of Asia, Africa and Europe in palæolithic times." Additional flints were later found "scattered all over the country, covering the ground sometimes for the space of half an acre," and there was discovered also an "unfinished spear-head on the ground surrounded by a mass of flakes and chips." This remarkable distribution over the country, Dr. Forbes remarks, "where no remains apparently exist of the deposits out of which they have been washed, seems difficult to reconcile with the usual process of denudation acting through the enormous period which has elapsed since the palæolithic age of Europe," and he disbelieves that "a nodule of stone surrounded by the flakes chipped from it tens or hundreds of thousands of years ago, could have remained undisturbed when the deposits by which it was covered have entirely disappeared"; he dissents also from the opinion that identity of form in the stone implements is sufficient evidence of unity of race or of close contact between the races who made them. He is of opinion, therefore, that none of the surface so-called palæolithic implements from Egypt and Somaliland "have yet been clearly proved to belong to that period, while the probability is that the bulk of them are of much later date." The only flint implements, Dr. Forbes adds, believed to be authentically palæolithic are the flakes and very rude scraper-like flints found by General Pitt-Rivers in the stratified indurated gravelly debris from a Wady near the Tombs of the Kings.

FIG. 2.—Flint knife from Wady el Sheikh.

ON THE MECHANISM OF GELATION, AND ON THE STABILITY OF HYDROSOLS.[1]

GELATINE-WATER-ALCOHOL and agar-water are colloidal mixtures which form a gel on cooling and a sol on warming. In both cases the formation of the gel is due to the separation of the fluid mixture into two partially miscible fluids or phases. When a certain critical temperature is reached, one of the phases separates out as a cloud of droplets. With a further fall of temperature either this internal phase or the external phase becomes a solid solution, and forms a framework in the spaces of which the still fluid solution is lodged. Thus two distinct types of gel occur. In the one the structure is a solid mass, in which are embedded spherical spaces filled with fluid. In the other it is an open spongework of adherent solid spheres with fluid filling the meshes. The former is firm and elastic, the latter is brittle and undergoes spontaneous shrinkage. In the ternary mixture the gel has the former structure when the gelatine content of the mixture is high; the latter when it is low.

The hydrogel of agar is built of a solid solution of water in agar, which forms a framework holding a fluid solution of agar in water. The concentration of each of these two co-existent solutions is dependent upon temperature, but the values vary according to whether the system is cooled down or warmed up to a given temperature. The system therefore

manifests a striking hysteresis. From the point of view of the phase rule the hydrogel of agar is a system of two components in three phases—a fluid, a solid, and a vapour phase. The composition of the phases should therefore be fixed by fixing either the temperature or the pressure. Fixing the temperature, however, does not fix the composition, and this is probably due to two things: (1) the fact that the surface which separates the fluid and solid phases is curved, and (2) the fact that that surface is freely permeable by the mobile molecules of water, but is relatively impermeable to the immobile molecule of agar. The system obviously has two pressures which determine equilibrium, a lower hydrostatic pressure on the convex side of the curved surface, and a higher on the concave side.

Hydrosols, such as those of gold, silver or hydrosulphides, are systems in which equilibrium is between a solid phase dispersed as minute particles, and a fluid phase which is a true solution of the substance of the solid phase. The behaviour of the particles in an electric field shows that each one is surrounded by a double electric layer, which can be destroyed by the addition of electrolytes, or, in some cases, by the removal of all electrolytes. When this is done aggregation or coagulation follows. The stability of these hydrosols, therefore, is due to a contact difference of potential between the solid and the fluid phases.

The addition of an electrolyte may bring about coagulation either by altering the potential of the fluid phase, so as to make it agree with that of the solid phase, or by furnishing "nuclei" about which the particles of solid aggregate. When the particles carry a negative charge, acids act by decreasing the positive charge of the fluid; when the particles carry a positive charge, alkalies act by decreasing the negative charge of the fluid. In these cases the coagulating power of the acid or alkali is directly measured by its chemical activity when dissolved in water. The relation is expressed by the formula

$$K = n\alpha(v + \nu)$$

when K is the specific molecular coagulative power of a substance as measured by the volume occupied by one gram mol., when it just suffices to coagulate the hydrosol.

The coagulating action of a salt is due to only one ion, which is always of the opposite electrical sign to the colloid particles. The valency of the active ion exerts a remarkable influence upon its coagulative power, the relation being approximately

$$I' : I'' : I''' = K : K^2 : K^3.$$

Therefore, to express the coagulating powers of salts, a factor which is approximately squared or cubed by a change from monovalent to di- or tri-valent ions must be added to the formula given above.

$$K = n\alpha(v + \nu)A^r.$$

Thomson has pointed out that double electric layers must be separated by a region of finite thickness, in which the components are in a state of uncompleted chemical combination. The solid and fluid phases in these hydrosols, therefore, are separated by a layer which possesses considerable chemical energy, and which is of very great extent, and this may account for their marked catalytic or ferment-like properties.