with secure establishment, and even dared, in 1861, to excommunicate the sultan, Abd el-Mejid, for failing to respect its pretensions.

The operations of the order are carried on by a system of graded officers, priests, and missionaries, which, as well as their adroit and varied methods, strongly recall the marvellous organization once attributed to the order of Jesuits. Nor has the result been less successful. Tribes alien and unreceptive, rulers cold or jealous, populations indifferent or contemptuous, have been won over and firmly attached to the order. The hard-worked native transfers his field to the society, preferring to lay up treasures in heaven. The fraternity digs wells in the desert, revives withered oases, protects its votaries from the nomad thieves of the Sahara, buys, instructs, and frees slaves, and sends them to their distant homes as missionaries, with astonishing results.

The headquarters of the order are at the zaouia, or convent, of Jarabub, founded in 1861, on the 30th parallel, near the western frontier of Egypt. Its population has increased marvellously during the last ten years. The place was originally a desert. The society built reservoirs, began plantations, erected convents; and in 1880 the body-guard of the head of the order was estimated to consist of four thousand men and about two thousand slaves. The metropolitan is the son of Sidi es-Senousi, whose genius he would appear to inherit, and is known as Sidi Mohammed el-Mahdi, having, like the false prophet of the Sudan, assumed, at his father's instigation, the title equivalent to a Moslem messiah. The convent has become an arsenal, possessing large stores of arms and ammunition, and even fifteen cannon purchased at Alexandria. Aid and comfort are lavishly extended to those who have from time to time revolted against France in Algeria.

Too wise to inaugurate as yet the holy war predicted of El-Mahdi, the head of the order has, nevertheless, provided against external aggression. Suspecting that its propaganda may eventually rouse the arms of civilization against it, it is said that there are constantly kept at the zaouia of Aziat in Cyrenaica, for example, five hundred camels with their harness and equipments, drivers, etc., ready at a moment's notice to convey to the interior the persons and property of the Senousian authorities. The fraternity possesses one of the best ports in North Africa, — Tobrug, — where an illegitimate trade flourishes, and does not want for manufactories of powder.

France is, so far, the only civilized nation which has suffered directly from the policy of the order. In Algeria most of the rebellions of late years are attributed to the new propaganda. The insurrections there have been imitated in the French district of Senegal. We have already referred to the probable connection of the order with recent events in the Sudan.

We have refrained from entering into a multitude of details which support the preceding conclusions, and it is not necessary to recount the different tribes and petty African states which have gradually become converts to the views of the fraternity. Enough has been said, however, to indicate the unsuspected importance of this new factor in the politics of Africa. The blood of many explorers and travellers bears testimony to the violence of its fanaticism; and neither the geographer nor the anthropologist can regard with indifference a movement which falls little short of that which originally propagated the faith of Islam.

W. H. DALL.

THE RUBY-HILL MINES, EUREKA, NEV.

MR. J. S. CURTIS, whose report on the silver-lead deposits of Eureka, Nev., is now in press, has prepared for exhibition at the New-Orleans exposition, by the U. S. geological survey, a model of the Ruby-hill mines, from which the largest portion of the metals extracted in the Eureka district has been taken. This model is eighteen inches in height, and about four feet long by eighteen inches wide. It is composed of glass plates horizontally arranged at distances of one inch apart, each inch representing a hundred feet, and the glass plate showing a section at each mine-level in the body of the model, the mine-levels being that distance apart. The upper plates, however, are closer together, and are cut to show the contours of the surface at distances of fifty feet apart.

On these plates the geological formations, three in number (quartzite, limestone, and shale), all of the Cambrian period, are colored with transparent colors. The ore-bodies, occurring only in the limestone and of tertiary or pre-tertiary age, are very irregular in form, and are shown by opaque red paint; while the mine-workings, shafts, tunnels, etc., are represented in opaque black paint. The effect of the model is as though a skeleton of the mine-workings and ore-bodies were seen suspended in a solid glass mass, the coloring of the geological structure not interfering with the view, on account of its transparency.

The dominant factor of the structure of Ruby Hill is an extensive fault, which has determined the present relations of the formations. The presence of this fault is marked by a fissure filled in places with rhyolite. This fissure also forms the hanging-wall of the ore-zone. Above the water-level the ore is prin-

cipally galena, anglesite, mimetite, and wulfenite, with very little quartz and calcite, the gangue being for the most part hydrated oxide of iron. It also carries gold and silver, and zinc is present probably as a silicate. Below the water-level it is composed chiefly of pyrite, arsenopyrite, galena, blende, and a few other sulphides, besides silver and gold.

The ore-deposits are confined to a mass of crushed limestone between the main fault and the quartzite. Those of any size are always capped by caves, or in some way connected with them and with fissures. The caves were probably formed subsequent to the deposition of the ore, being due, partly to the action of water carrying carbonic acid, and partly to shrinkage of the ore from decomposition. Since the latter occurred, the ore has in many instances been redistributed by the flow of underground waters, whose former presence is indicated by stratification of portions of the ore-bodies, and by traces of aqueous agencies in the surrounding limestone.

The constituents of the ore were probably derived by solution from some massive rock, not sedimentary, as assays of the country rock show that they could not have been so derived. The solutions were due to solfataric action, incident to the eruption of large masses of rhyolite. They entered the limestone from below, through fissures; and the greater part, at least, of the ore, was deposited by direct substitution for that rock. The limestone was fissured and crushed in many directions by the various faulting movements, and gave free ingress to the ore-bearing solutions, which naturally followed the channels of least resistance, and deposited the ore in masses of very irregular form. These are well shown in the model.

From the year 1869 up to the present time (1884) the Eureka district has produced about sixty million dollars of gold and silver, and about two hundred and twenty-five thousand tons of lead: and, as already stated, the largest portion of these metals was derived from the Ruby-hill mines.

TWO LARGE SUN-SPOTS.[1]

THE figures of sun-spots given with this article are from drawings made at the observatory at Palermo, and represent two of the largest spots observed during the last two years, so remarkable for the number of spots seen. Not only was their extent (which is readily appreciated by comparison with the figure of the earth given on each plate) immense, but the changes which were seen to take place were most rapid.

The first appeared on the eastern limb of the sun on June 25, 1883, about at latitude +7° 55′. After undergoing various transformations, it offered, on the 30th of June, the curious aspect shown in fig. 1. The spot was double; and its extreme length from east to west was not less than ten earth diameters, or about 3′. Considerable movements were agitating it. Two days afterward, on the 2d of July, the two parts had separated, and between them the photosphere shone with marked whiteness. From day to day this separation increased, until the 8th, when the spots disappeared on the western limb, after a deviation toward the north of 2° 30′. From the 28th of June to the 2d of July, long, brilliant tongues, ending in

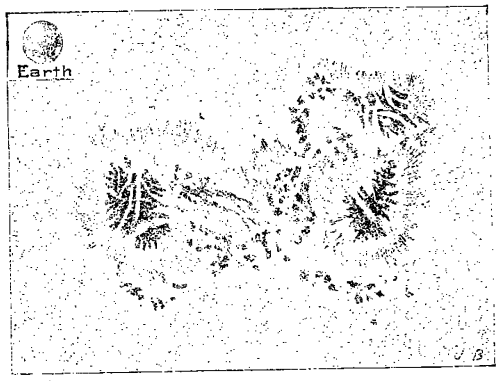

FIG. 1.

red hydrogen flames, were seen extending into the umbra; and a yellow coloring was observed on the penumbra and on some of the tongues, perhaps due to the presence of sodium (fig. 2).

This large spot was preceded and followed, on the limbs of the sun, by small but brilliant solar protuberances. It returned July 2, at latitude 8° 11′, much smaller and more regularly shaped, to make once more the tour across the disk of the sun, and disappeared at latitude +8° 23′, not to be seen again.

The second spot (figs. 3 and 4) was first seen on the

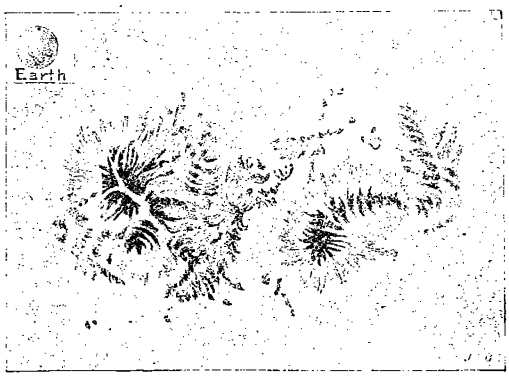

FIG. 2.

eastern limb, on the 10th of July, in latitude —7° 40′. It offered a strange appearance, and appeared to be the seat of much disturbance. On the 25th the centre was covered with luminous points which were in constant motion; and some strange lines of light seemed to be suspended over the umbra. The diam-

[1] Reproduced, with the cuts, from *L'Astronomie*.