and a general exposition of the progress of science in its several departments.

This Journal was established in 1819 by Professor Silliman, and has reached its 34th year. A Second Series was commenced, January, 1846, and the 15th volume of the new series begins with the number for January, 1853. We commend this Journal to the attention and substantial support of all friends of science.

SCIENTIFIC INTELLIGENCE.

"On the Optical Properties of a recently-discovered Salt of Quinine," *by Prof. Stokes.*—This salt is described by Dr. Herapath in the Philosophical Magazine, and is easily formed in the way there recommended namely, by dissolving disulphate of quinine in warm acetic acid, adding a few drops of a solution of iodine in alcohol, and allowing the liquid to cool; when the salt crystallizes in thin scales, reflecting (while immersed in the fluid) a green light with a metallic lustre. When taken out of the flui' the crystals are yellowish green by reflected light, with a metallic aspect. The following observations were made with small crystals formed in this manner:—The crystals possess in an eminent degree the property of polarizing light, so that Dr. Herapath proposed to employ them instead of tourmalines, for which they would form an admirable substitute, could they be obtained in sufficient size. They appear to belong to the prismatic system: at any rate, they are symmetrical (so far as relates to their optical properties and to the directions of their lateral faces) with respect to two rectangular planes perpendicular to the scales. These planes will here be called respectively the *principal plane of the length* and the *principal plane of the breadth*, the crystals being usually longest in the direction of the former plane. When the crystals are viewed by light directly transmitted, which is either polarized before incidence or analyzed after transmission, so as to retain only light polarized in one of the principal planes, it is found that with respect to light polarized in the principal plane of the length the crystals are transparent and nearly colourless,—at least when they are as thin as those which are usually formed by the method above mentioned. But with respect to light polarized in the principal plane of the breadth, the thicker crystals are perfectly black, the thinner ones only transmitting light, which is of a deep red colour. When the crystals are examined by the light reflected at the smallest angle with which the observation is practicable, and the reflected light is analyzed, so as to retain,—first, light polarized in the length, and secondly, light polarized in the other principal plane,—it is found that in the first case the crystals have a vitreous lustre, and the reflected light is colourless, while in the second case the light is yellowish green, and the crystals have a metallic lustre. When the plane of incidence is the principal plane of the length, and the angle of incidence is increased from $0°$ to $90°$, the part of the reflected pencil which is polarized in the plane of incidence undergoes no remarkable change, except perhaps that the lustre becomes somewhat metallic. When the part which is polarized in a plane perpendicular to the former is examined, it is found that the crystals have no angle of polarization, the reflected light never vanishing, but only changing its colour, passing from yellowish green, which it was at first, to a deep steel blue, which colour it assumes at a considerable angle of incidence. When the light reflected in the principal plane of the breadth is examined in a similar manner, the pencil which is polarized in the plane of incidence undergoes no remarkable change, continuing to have the appearance of being reflected from a metal, while the other or colourless pencil vanishes at a certain angle and afterwards reappears, so that in this plane the crystals have a polarizing angle. If then, for distinction's sake, we call the two pencils which the crystals, as belonging to a doubly refracting medium, transmit independently of each other, *ordinary* and *extraordinary*, the former being that which is transmitted with little loss, we may say, speaking approximatively, that the medium is transparent with respect to the ordinary ray, and opaque with respect to the extraordinary, while as regards reflexion, the crystals have the properties of a transparent medium or of a metal according as the refracted ray is the ordinary or the extraordinary. If common light merely be used, both refracted pencils are produced, and the corresponding reflected pencils are mixed together; but by alyzing the reflected light, by means of a Nicol's prism, the reflected pencils may be viewed separately,—at least when the observations are confined to the principal planes. The crystals are no doubt biaxal, and the pencils here called ordinary and extraordinary are those which in the language of theory correspond to different sheets of the wave surface. The reflecting properties of the crystals may be embraced in one view, by regarding the medium as not only doubly refracting and doubly absorbing, but *doubly metallic* The *metallicity*, so to speak, of the medium of course alters continuously with the point of the wave surface to which the pencil considered belongs, and doubtless is not mathematically null even for the ordinary ray. If the reflection be really of a metallic nature, it ought to produce a relative change in the phases of vibration of light polarized in and perpendicularly to the plane of incidence. This conclusion the author has verified by means of the effect produced on the rings of calcareous spar. Since the crystals were too small for individual examination in this experiment, the observation was made with a mass of scales deposited on a flat black surface, and arranged at random as regards the azimuth of their principal planes. The direction of the change is the same as in the case of a metal, and accordingly the reverse of that which is observed in total internal reflection. In the case of the extraordinary pencil the crystals are least opaque with respect to red light, and accordingly they are less metallic with respect to red light than to light of higher refrangibility. This is shown by the green colour of the reflected light when the crystals are immersed in fluid; so that the reflexion which they exhibit as a transparent medium is in a good measure destroyed. The author has examined the crystals for a change of refrangibility, and found that they do not exhibit it. Safflower red, which possesses metallic optical properties, does change the refrangibility of a portion of the incident light; but the yellowish green light which this substance reflects is really due to its metallicity, and not to the change of refrangibility, for the light emitted from the latter cause is red, besides which it is totally different in other respects from regularly reflected light. In conclusion, the author observed that the general fact of the reflection of coloured polarized pencils had been discovered by Sir David Brewster in the case of chrysammate of potash;* and in a subsequent communication he had noticed in the case of other crystals the difference of effect depending upon the azimuth of the plane of incidence.† Accordingly, the object of the present communication was merely to point out the intimate connexion which exists (at least in the case of the salt of quinine) between the coloured reflection, the double absorption, and the metallic properties of the medium.

Specimens of Sensitive Media were exhibited by Professor Stokes. These were:—a crystal of green fluor spar, which, by the developement of blue light within it, changed its colour;—the solution of the common disulphate of quinine in acidulated water, which, by its action on the invisible rays developed blue light; and the solution of the green colouring matter of leaves in alcohol, which by a simila• action became blood red.

Reduction of Metals by Phosphorus and Sulphur.—It had been observed by Woehler that phosphorus in combination with copper excites an electrical current. M. Wicke has made the following observations:—

1. A stick of phosphorus wound round with a strip of silver was placed in a highly concentrated solution of nitrate of silver. The silver and phosphorus instantly became covered with a blackish film; afterwards silver began to be reduced in a wart-like form upon the strip of silver; and after the lapse of a few weeks it was covered with an extremely shining coating of crystalline silver, although not in immediate contact with the phosphorus. The whole of the reduced silver could be removed from the strip of silver as a compact coating with a shining inner surface. The phosphorus was only covered superficially with a thin coating of dark phosphuret of silver, and remained unchanged internally. The silver separated so evenly, and with such a shining surface, that this process might perhaps be employed for galvanoplastic purposes.

2. In a similar manner, by a combination of phosphorus and lead in a solution of nitrate of lead, the reduction of crystallized lead took place upon the lead, whilst the phosphorus was covered with a thin black film; the action, however, was weak, and soon stopped altogether.

3. A stick of phosphorus was placed on the axis of a closely-pressed mass of oxide of copper, both covered with water, with which the tube was filled, and then made air-tight; the reduction of the oxide to metallic copper was gradually effected, so that after several weeks the stick of phosphorus, which was still remaining, was surrounded by a capsule of crystalline copper.

4. Sulphur, surrounded with a strip of lead, and laid in solution of nitrate of lead, effected the reduction of lead upon the lead in form of a loose crystalline coating.

5. When a piece of sulphur, surrounded with a bright copper wire, was laid in a saturated solution of sulphate of copper, it became covered after some time, in the place where the copper touched it, with a loose crystalline coating of indigo-coloured sulphuret of copper, whilst the copper wire was dissolved. A solution of nitrate of copper

* Report of the Meeting of the British Association at Southampton in 1846 Part II., p. 7.

† Ditto Oxford, 1847.