believe, the first to arrive at the correct and simple explanation, and he was the first to describe the red flash. His observations are, I believe, recorded in back numbers of NATURE, and in other journals.

I have made very numerous observations of the green flash, at sea and on land, and have confirmed Mr. Whitmell's conclusions.

If the sun is observed in an achromatic telescope when near the horizon, a green fringe is seen round the upper limb, and a red fringe round the lower limb, due of course to atmospheric dispersion. This green upper segment remains visible for about a second or perhaps two after the sun has set, and it sometimes turns a beautiful violet at the last instant if the atmosphere is clear enough to transmit violet light. The green may be seen with a telescope or binoculars at any sunset or sunrise, in clear air and with a low horizon. It is conspicuous to unaided vision only under certain conditions at sea, when mirage effects enhance its brilliancy (NATURE, vol. 111, p. 13).

The red fringe may also be seen when the lower limb emerges from the sharp boundary of a dense cloud near the horizon, but the necessary conditions for seeing this 'red flash' are rare.

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Highbroom,
Ewhurst, Guildford,
Dec. 3.

THIS summer, six of us were watching the sun set behind the hills of Jura in a sky absolutely free from cloud and haze. We stood on a moderately high hill, and the sea, four miles broad, lay between us and Jura. Four had not even heard of 'the green ray.' I, who had seen the ray on other occasions, suggested that five of us should turn our backs to the sun and close our eyes until the sixth should signal that the upper edge of the sun was disappearing. On his signal we turned, and each saw for an appreciable time a thread of bright green light lining the silhouette of the island at the point where the sun was last seen. In the case of the five, at any rate, this could not have been a subjective after-image.

WILLIAM SEMPLE.

Mile Ash,
Dumfries.

Chinese Alchemy.

COMMUNICATIONS upon the subject of Chinese alchemy have appeared several times in NATURE during the past year by Prof. J. R. Partington and have greatly interested me. The Pent'sao and similar books upon Chinese mineral drugs make repeated reference to the transmutation of metals into gold. However, few of these books have very old editions extant, so I have been looking up the subject of alchemy from other sources.

With the help of Mr. Chen Yung, I have made the following abstracts from books referring to this subject:

(1) 116 B.C., Ssu Ma Ch'ien wrote "The Shih Chi." He discusses the history of Ch'in Shih Huang Ti (221 B.C.) and states: "Hsu Shih led several thousand boys and girls to search for the immortals in the sea, where there were three mountains, P'eng lai, Fang shan, and Yin chou.

"Ch'in Shih Huang Ti was unable to find the miracle medicine 'ch'i yao' because things came to harm him; but after he had been protected from the devils, he was able to find it.

"Lu Sheng wished Ch'in Shih Huang Ti not to let

others know where he lived, then he can obtain this medicine of immortality, 'Pu ssu chih yao.'

"Ch'in Shih Huang Ti directed a large number of scholars and magicians to make the country peaceful by producing the magic medicine.

"Li Shao-chun said to Han Wu Ti, cinnabar can be smelted to form pure gold; this made into eating utensils, when used will produce longevity: with longevity one is able to visit the immortals of the P'eng lai mountain, the worship of whom will bestow immortality.

"Then Han Wu Ti sent the Fang Shih into the sea to find the immortals of the P'eng lai mountain, and others he sent to smelt cinnabar with other medicines to change them into gold.

"Although much money was spent they did not succeed in finding the immortals and immortality."

(2) 92 B.C. In the Shen-hsien-chuan we read that the "King of Huai nan," named "Liu an," kept several thousand people who wrote many books, of which eight chapters were upon the immortals and alchemy.

These writings are repeatedly referred to in other works. They are now lost, but their existence and substance matter were definitely established.

(3) A.D. 142. Wei Po-yang wrote the "T'san T'ung Ch'i," which he stated was the first book on internal alchemy (nei chin tan). It is included in the "Ssu-ku-ch'uan-shu" (the Imperial Encyclopædia), which establishes its reliability in the eyes of the Chinese. In the chapter upon "the creation of true earth" he refers to "the many fruitless attempts of men to make the philosopher's stone, by heating together Tangut ore, talcum, alum, magnetic iron ore, and sulphur. These are useless, because they are foreign to the body. Used a thousand times they will fail ten thousand."

He believes in immortality from the true harmony produced by water and earth in the body, but he expressly opposed the alchemy of his day which tried to produce immortality by chemical means.

Ko Hung, in writing "Pao P'u Tzu," states that "Wei Po-yang was the 'Father of Alchemy,' and had three disciples who went into the mountains to make medicines. When made, they first tried them on dogs to see if they were fatal or immortal in their effects. Dogs died when fed on them; one of the disciples ate one and he also died. Wei Po-yang also ate one and died, etc. When they were being put into their coffins they resurrected." This account occurs in "Li-tai-shen-hsien-ch'uan," which is not so trustworthy as the "Tsan T'ung Ch'i."

I should like to emphasise in this material two points:

(1) Prof. Partington agrees that the accuracy of Ssu Ma Ch'ien's work seems to be unquestionable. In this we read, Ch'in Shih Huang Ti directed a large number of magicians to make the philosopher's stone. Now a large number could not have been in existence if alchemy had not been already well established by that time, 221 B.C., as concluded by the writers of the Bengal Monograph.

(2) The writings of Wei Po-yang are apparently quite authentic. The book I have quoted makes constant reference to the pill of immortality and the many schools which supported the use of mineral drugs to produce immortality, whereas the writer claimed the production of internal harmony as all important to immortality. His treatise implies a well-established school of alchemy in his day which also antedates "Pao P'u Tzu."

If the above evidences be accepted, it gives further strong support to the independent origin of Chinese alchemy, that it antedated the Egyptian school, and