magnesium phosphate. Nothing new is claimed for the work.

The superphosphate used was home-made from ground rock. All but about three-quarters of one per cent of the phosphoric acid was water-soluble. Aqua regia was used to dissolve the phosphoric acid.

For the determination of the phosphoric acid various procedures were carried out as follows:

A—The Official Method.¹

B—The Official Method modified by evaporating the liquid on a water bath, taking up with dilute nitric acid and filtering through paper to remove silica before precipitation.

C—Direct weighing of the yellow precipitate as outlined by Baxter.²

D—The volumetric process of Pemberton as described by Wiley.³

E—The direct precipitation of ammonium magnesium phosphate in the presence of ammonium citrate.⁴

F—Same as E, substituting citric acid for ammonium citrate.⁵

None of these methods require description. However, the apparatus used for heating the yellow precipitate to 290°–300°, as outlined by Baxter, will be described. This consisted of two 6-in. iron dishes, deep form, such as are used for sand baths. The edges of one dish were cut back $\frac{3}{4}$ in. every half inch and bent in so as to make a cover for the uncut dish. A hole in the top of the cover held a cork and thermometer. Triangles inside were arranged to hold two or three crucibles, each covered with a small watch glass. An asbestos jacket consisting of a side and top prevented the radiation of heat. The whole was heated with a Bunsen burner, the flame being protected from draft by an iron conical shield 8 in. high.

The results obtained by the different methods are given in Table I, each determination made being listed.

TABLE I—TOTAL PHOSPHORIC ACID IN SUPERPHOSPHATE

METHOD	DUPLICATES Per cent		Average Variation Per cent		REMARKS
			Per cent	from B Per cent	
A—Official Method...	15.30	15.25	15.28	+0.26	No silica removed
B—Official Method (modified).....	15.07	14.97	15.02	0.00	Silica removed
C—Direct weight of yellow ppt.....	14.81	14.81	14.82	—0.20	Temp. 290°–300°
C ₁ —Same as C but overheated.....	14.53	14.54	14.54	—0.48	Temp. 300°–330°
D—Volumetric method.....	14.80	14.86	14.83	—0.19	KOH : HNO ₃
E—Pptd. as NH ₄ Mg- PO ₄	14.85	14.94	14.88	—0.14	In am. citrate
F—Pptd. as NH ₄ Mg- PO ₄	16.50	16.29	16.39	+1.37	In citric acid

From the comparison of the results given under A and B in Table I it would be inferred that there was 0.26 per cent of silica in the pyrophosphate when the solution of total phosphoric acid before precipitation with molybdate was not evaporated to dryness. The results indicated under C, D and E, which were

obtained by direct weighing of the yellow precipitate by the volumetric method and by precipitation in ammonium citrate, are, on the average, 0.17 per cent less than those listed under B. If the results obtained under B—silica-free—are taken as standard, then it is apparent that either of three more rapid methods (C, D or E) give as accurate results as the Official Gravimetric Method. No attempt was made to find silica in any of the precipitates as its presence is generally acknowledged.¹ The results given under C₁ show the decomposition of ammonium molybdate by temperature over 300° and the resulting negative error.

CONCLUSION

The above work emphasizes what is already known:

I—That the Official Gravimetric Method of determining total phosphoric acid gives high results when phosphoric acid is determined in superphosphate without evaporation of the solution to dryness on a steam bath to remove silica.

II—That several methods other than the Official Gravimetric give equally good results in half the time.

DEPARTMENT OF GENERAL AND AGRICULTURAL CHEMISTRY
MASSACHUSETTS AGRICULTURAL COLLEGE, AMHERST

CLEANING SOILS FOR MICROSCOPIC EXAMINATION

By W. H. FRY AND JOHN A. CULLEN

Received Oct. 22, 1914

In microscopic mineralogical work on soils it is necessary that the grains be transparent or at least strongly translucent and that the grain-surfaces be free from all coatings and adhering material. Where light is not transmitted, the optical properties of the minerals cannot be determined in soil preparations; and where the material carries an appreciable coating of some foreign substance the refractive index determined will be that of the coating instead of the mineral, even though the determination of other optical properties of the grain under examination may remain unaffected.

Many soils have their constituent grains more or less stained and coated by various substances. Often simple washing and drying serve to render them adaptable to microscopic examination. But in a great number of cases the grains are so coated with iron oxides, hydroxides, or both, that other means of cleansing have to be resorted to. That cleansing agent would be most efficient which, while entirely removing the iron and other stains, at the same time had the least decomposing action on the minerals themselves.

Hydrochloric and nitric acids act very energetically upon apatite, the determination of the presence of which is sometimes the primary object of the examination. Sulfuric acid cannot be used for the same reason, and in addition has the disadvantage of decomposing biotite, a common soil constituent.

Several readily available organic acids were tested on various soils, different concentrations of the various acids being used in order to ascertain the most efficient

¹ Bull. 107, p. 2.

² Am. Chem. J., 39 (1902), 298.

³ Wiley, "Principles and Practice of Agricultural Chemistry," II (1908), p. 160.

⁴ Wiley, *Ibid.*, II (1908), p. 88.

⁵ Wiley, *Ibid.*, II (1908), p. 98.

¹ Wiley, *loc. cit.*, p. 78.

strength. It has been found that, in general, 10 per cent oxalic acid best serves the purpose. In about 30 minutes it removes the iron stains satisfactorily. Tests upon various soil minerals showed that, with the exception of apatite, it did not affect them appreciably; and in the case of apatite, although there is undoubtedly some effect, it leaves that mineral in a

determinable state. Of course, in any case calcite would be removed—a fact which renders very difficult the determination of small quantities of this mineral in discolored soils.

BUREAU OF SOILS
U. S. DEPARTMENT OF AGRICULTURE
WASHINGTON

LABORATORY AND PLANT

REPORT OF THE SELBY SMELTER COMMISSION

Received December 8, 1914

The filing of the report, findings and recommendations of the Selby Smelter Commission with the Superior Court of Solano County settles finally and conclusively the long continued controversy between the residents of Benicia and the adjacent agricultural country and the Selby Smelting and Lead Company concerning the alleged disagreeable and injurious effects produced by the smoke from the Selby Smelter.

The smelter operated by the Selby Smelting and Lead Company is situated near Vallejo Junction in Contra Costa County, California, at the western end of the Carquinez Straits. The City of Benicia is situated in Solano County at the eastern end of the Straits, about five miles from the smelter. During nine months of the year the prevalent trade winds blow the smoke from the Selby Smelter over and into the City of Benicia and the agricultural area lying between Benicia and Vallejo.

On March 14, 1905, action was brought by the District Attorney of Solano County, California, in the Superior Court of Solano County, praying for an injunction which would restrain and enjoin the Selby Smelting and Lead Company from permitting injurious smoke and gas from the Selby Smelter to blow over and upon the City of Benicia and the tributary country. The case was brought to trial on August 7, 1906, and judgment of the Court in favor of the Plaintiff was rendered on July 16, 1908. The decree of the Court was to the effect that during eight months of each year between the 15th of March and the 15th of November, the Selby Company was enjoined from discharging noxious gases and fumes into the open air in such a manner that the same would be carried into and upon the City of Benicia and the tributary country in Solano County in such quantities as to be offensive to the senses and to interfere with the comfortable enjoyment of life and property.

After motion for a new trial was made by the Defendant and denied by the Court, an appeal was thereupon taken to the Supreme Court of the State. On June 12, 1912, the judgment of the trial court was affirmed by the Supreme Court.

During the period covered by this litigation the Selby Company had been making efforts toward the elimination of some of the objectionable constituents of the smoke, these efforts having resulted in the removal of the major portion of lead, arsenic and sulfur trioxide from the smelter smoke.

In the spring of 1913, although the Selby Company maintained that they had abated the nuisance, complaints were made by the residents of the area that a nuisance still existed, and that the decree of the Court was, therefore, being violated by the Smelting Company.

Various considerations, among them the prospective heavy expense which would accrue to both parties to the litigation as a result of a trial of the Smelter Company for contempt of Court, led to conferences of the attorneys representing both sides, which resulted in an agreement to submit the question of fact as to the violation of the decree of injunction to a board of technically trained men, deemed by both sides to be qualified to act in such a capacity, and equal financial responsibility of the parties in the expense of the Commission's activities. The result of the agreement was the filing of a stipulation in the record of the cause providing for such a board.

ORGANIZATION OF COMMISSION

On May 22, 1913, this board was organized as the Selby Smelter Commission, with the following personnel:

J. A. HOLMES, Director U. S. Bureau of Mines.
E. C. FRANKLIN (at the time of appointment Chief of the Chemical Division of the Hygienic Laboratory of the U. S. Public Health Service), Professor of Organic Chemistry, Leland Stanford, Jr., University.
RALPH A. GOULD, Chemical Engineer, San Francisco, Secretary of the Commission.

The function of the Selby Smelter Commission was to determine the facts and report its findings on the following:

- 1—Is the Selby Smelter operating in such a manner as to violate the decree of the Court dated July 16, 1908?
- 2—If the Defendant Company is violating the decree, what is the extent of the violation?
- 3—If the Defendant Company is violating the decree, what steps must be taken by the Defendant to avoid a violation of the decree?

For the determination of facts, the Commission and its staff have carried on very careful and complete investigations of all matters which in the opinion of the Commission could have any bearing on the questions at issue and to be answered. These investigations were made by the following staff of trained scientific and technical men, no one of whom, otherwise than in arriving at the truth, was directly or indirectly interested in the findings of the Commission:

A. E. WELLS, Metallurgist and Chief Chemist, in charge of Smelter Investigations and Field Work.
C. B. DUTTON, Special Legal Agent, U. S. Bureau of Mines.