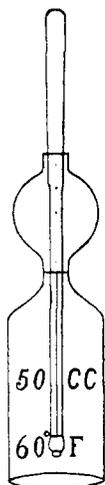


VII.—A NEW SPECIFIC GRAVITY BOTTLE.

BY DR. W. H. GREGG.

In taking the specific gravity of corrosive and volatile fluids, the ordinary specific gravity bottle presents some objections. The stoppers are usually perforated, with a view of affording a full passage for the excess of fluid when the stopper is inserted into its place. This is very objectionable with corrosive fluids, such as oil vitriol, and such volatile fluids as ether, chloroform, etc.



For such substances, a modification of Regnault's specific gravity bottle is presented, which does not allow any overflow of its contents when the stopper is inserted, and at the same time a thermometer is at hand to note the temperature. Such a bottle is shown in the figure. The neck is drawn out as in Regnault's, and marked to indicate its capacity. A short distance above the mark the neck swells out sufficiently to contain an amount of fluid equal to that displaced by the thermometer tube. The thermometer is attached to the stopper which is ground into the neck at the top as on the ordinary bottle, to prevent loss by evaporation.

Elmira, N. Y.

VIII.—ON THE SOLVENT ACTION OF CARBONIC ANHYDRIDE IN SOLUTION, UPON VARIOUS BODIES, UNDER DIFFERENT CONDITIONS AS TO TEMPERATURE AND PRESSURE.

BY J. H. TUCKER, PH.D.

It is well known that carbonic acid gas in solution, is capable of exerting a great chemical influence upon the materials forming the earth's crust, and as the air and all natural waters are impregnated with it, the range of its action is necessarily extensive. Among the bodies thus acted upon by carbonic acid, may be mentioned the carbonates and silicates as the most important. The insoluble carbonates are dissolved, soluble bicarbonates being formed, the extra equivalent of carbonic acid being given up again on heating the solution. The silicates are decomposed, the base is converted into carbonate or acid carbonate, the silica remaining insoluble; the decomposition or "rotting" of feldspathic rocks is a prominent example of this. In addition to the compounds mentioned, the tribasic phos-

phates of lime and magnesia, the fluoride of calcium and phosphate of alumina, are known to be soluble in a solution of carbonic anhydride. It has been claimed that silica in the hydrated state is soluble, but the results of my experiments with ferrous silicate, as far as they go, seem to negative that claim. There is good ground, however, for believing that a large number of the constituents of rock masses are decomposed by carbonic acid, and it will be the chief object of an extension of this investigation to examine these decompositions, and determine their quantitative relations.

As far as I am aware,* the only work that has been done on this subject in a quantitative way, has been principally by Bischoff (*Chemical and Physical Geology, English Ed.*), who has limited his experiments mostly to the carbonates of lime and magnesia, which were performed only at a single temperature and pressure. Lassaigue (*Journ. Chim. Med.*, 1848, 312) states that water saturated with carbonic acid, dissolves $\frac{1}{1128}$ part of calcic carbonate at 0° C., and $\frac{1}{1138}$ part at 10° C.; and Warrington (*Journal Chemical Society*, 2, 9, 80) states that one part of calcium phosphate in calcined bone-ash, dissolves on the average in 6788 parts of the saturated water.

In view of the importance of the *role* played by carbonic acid in geological changes, and the modifying influence which we know differences of temperature and pressure exert upon its action, I have thought it would be useful to make quantitative determinations of the solvent action on various bodies at varying temperatures and pressures. The following is the method adopted to carrying on the experiments: At ordinary pressure, the purified gas was passed into distilled water containing a large excess of the substance under examination, in a minute state of division, the passage of the gas being continued for six or eight hours until it ceased to be absorbed.

For the pressure effects, the finely divided substance was diffused through water; the gas passed at ordinary pressure for an hour, and then the whole exposed to a pressure of one atmosphere for six to eight hours, the containing vessel being frequently agitated to aid the absorption of the gas. The results obtained at 0° C. were by artificial cooling with ice.

FERROUS CARBONATE.

I. *At 0° C.*—1. Well washed hydrated ferrous carbonate, only slightly oxidised, was diffused through distilled water and the gas passed:

* Schloesing, *Journ. Chem. Soc.* 2, 10, 788; Cossa, *Zeitschr. f. Anal. Chem.*, 1869, 145.

After $1\frac{1}{2}$ hours, one liter of solution contained 1.308 grm FeCO_3 .

"	3	"	"	"	"	1.632	"	"
"	$4\frac{1}{2}$	"	"	"	"	2.332	"	"
"	6	"	"	"	"	2.594	"	"

2. In another experiment, the gas was passed for $4\frac{1}{2}$ hours when one liter of solution contained 2.512 grms FeCO_3 .

II. *At ordinary temperature.*—Conditions as above :

Time, eight hours. One liter of solution contained :

At 23°C ., 1.046 grm FeCO_3 .

At 21°C ., 1.134 " "

III. *Under pressure.*—One liter of solution contained :

(1.) 1.520 grm FeCO_3 .

(2.) 1.374 " "

Siderite.—A well crystallized specimen was reduced to fine powder and treated as above at 24°C ., under atmospheric pressure.

One liter of solution contained : 0.480 grm FeCO_3 .

CALCIUM CARBONATE.

I. *At 0°C .*—The carbonate used was formed by precipitating a solution of calcium chloride.

One liter of solution contained : 2.444 grms CaCO_3 .

II. *At ordinary temperature.*—One liter of solution contained at 28°C ., 0.894 grm CaCO_3 .

III. *Under pressure.*—One liter of solution contained at 21°C ., 1.1824 grm CaCO_3 .

IV. *Marble.*—Ordinary crystalline marble was finely powdered and submitted to the action of the gas :

At 22°C ., and under ordinary pressure, one liter of solution contained 1.036 grm CaCO_3 .

MAGNESIUM CARBONATE.

I. *At 0°C .*

II. *At 30°C .*—One liter of solution contained 10.676 grms MgCO_3 .

III. *Under pressure.*—One liter contained, at 26°C ., 18.520 grms MgCO_3 .

The carbonate operated upon was obtained by precipitating a solution of magnesian sulphate at boiling temperature, with sodium carbonate.

ANKERITE.

(Carbonate of lime, magnesia and ferrous oxide.)

Native ankerite consisting of the powdered crystals, was treated with carbonic acid gas at 25° C., in the usual way, under ordinary pressure.

One liter of solution contained 0.318 grm CaCO₃, 0.313 grm MgCO₃, with a little FeCO₃.

It will be observed that the relative amounts dissolved of the calcium and magnesium salts, are very different from those dissolved when the salts are operated upon separately.

MANGANESE CARBONATE.

Artificial hydrated Carbonate.

At 0° C.—One liter of solution contained 0.396 grm MnCO₃.

At 26° C.—One liter of solution contained 0.239 grm MnCO₃.

Under pressure, at 23° C.—One liter of solution contained 0.376 grm MnCO₃.

TRIBASIC PHOSPHATE OF LIME.

In the hydrated state, prepared by precipitating a solution of calcium chloride with sodium orthophosphate.

At 25° C.—One liter of solution contained 0.396 grm anhydrous phosphate.

Under pressure, at 28° C.—One liter of solution contained 0.464 grm anhydrous phosphate.

PURE HYDRATED ALUMINA

Exposed to the action of the gas in the usual manner, showed not the slightest solubility under any temperature and pressure.

HYDRATED SILICATE OF PROTOXIDE OF IRON

Prepared by precipitation, was exposed to the action of the gas at 23° C. and ordinary pressure.

One liter of resulting solution contained 0.330 grm FeCO₃.

On careful testing of the same solution, no trace of silica was found.

From these results it may be observed :

1. That difference in temperature produces a marked difference in the amount carried into solution ; the lower the temperature, the more being dissolved.

2. That increase in pressure causes a considerable increase in matter dissolved, though the effect is not so great as in the case of

change in temperature ; carbonate of lime seems to be an exception to this, increased pressure appearing to make little difference.

3. Substances in the native state, as compared with those artificially prepared, are, as would be expected, less soluble, but they are sufficiently soluble to fully account for the profound geological changes that have been produced by carbonic acid gas.

IX.—NOTE ON SULPHURETTED HYDROGEN.

By P. CASAMAJOR.

In 1873, Mr. William Skey, Analyst to the Geological Survey of New Zealand, published some interesting observations* on the production of sulphuretted hydrogen, when a voltaic couple is formed with zinc as the positive, and a metallic sulphuret as the negative plate. When placed in contact with zinc, or in communication with this metal, by means of a wire, many sulphurets give sulphuretted hydrogen very freely, with sulphuric or hydrochloric acid, which alone would not give any in contact with these acids. This happens with galena and sulphuret of copper.

I have had occasion lately to apply these researches of Mr. Skey to the production of sulphuretted hydrogen from sulphuret of iron, which refused to give it in the presence of sulphuric acid diluted with ten times its volume of water. I believe that the greater part of the sulphuret of iron sold to chemists possesses this resistance to acids. I have found none lately which gave sulphuretted hydrogen easily, and I had accumulated several pounds lately possessing this undesirable quality.

After a few trials I was able to obtain an abundant supply of sulphuretted hydrogen from any sample of sulphuret of iron, by proceeding as follows: Enough mercury is put in a bottle to cover the bottom entirely. Over this diluted sulphuric acid is poured, and some pieces of zinc are thrown in, which immediately sink in the mercury, forming a zinc amalgam with great excess of mercury. No action takes place between the zinc and the acid. If now a few pieces of sulphuret of iron are thrown in the bottle, they will sink to the mercury, and a copious discharge of sulphuretted hydrogen will take place from the surface of the sulphuret of iron. This production will continue with remarkable regularity until either the zinc, the sulphuret of iron, or the sulphuric acid is exhausted. As to the mercury, it

* *Chemical News*, 27, 161.