used as the reducing agent, no conditions could be found where silicon could be distinguished from germanium and where phosphorus could be distinguished from arsenic (V). Such differentiations probably cannot be made by the selection of some other reducing agent. Under certain acidity conditions, it is possible to minimize the interference of Ge and Si on the phosphorus determination, especially when the organic reductant is used, but such procedures are not recommended.

The recommended procedure for the determination of phosphorus makes provision for the separation of microgram amounts of phosphorus from at least 1 mg each of AS_2O_5, GeO_2 and SiO_2. The phosphate in ocean waters is concentrated by precipitating $Al(OH)_3$, which serves as a carrier for the $AlPO_4$ formed. The small precipitate is treated with a small volume of solution containing HF, HBr, HCl, and H_2SO_4 to volatilize any coprecipitated As, Ge, or Si. The phosphate is then determined by the molybdenum blue reaction according to specific optimum conditions. The total P_2O_5 content of several samples of sea water collected from the Gulf of Mexico ranged from 1.8 to 5.9×10^{-6} percent.

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Studies of Evaporation

THE lack of a direct method of measurement of evaporation from large land and water areas constitutes one of the basic gaps in hydrologic inventory. The need for direct measurement of evaporation is particularly keen in the western states where problems of allocation and distribution of available water supplies require accurate accounting.

Ordinarily evaporation (aside from pan estimates) is determined by hydrometric methods, as the difference between measured inflow and outflow. However, the large body of untested theory concerning evaporation processes themselves gives some reason to search for more direct measurements that could be used at the large number of places where hydrometric methods are not applicable or sufficiently precise. Thus it is desired that methods be developed whereby the proposed geophysical principles can be depended upon for primary measurement of evaporation under field operating conditions.

The first step, therefore, was to verify these untested geophysical methods at a lake where it was possible to obtain an accurate determination of evaporation by known and familiar hydrometric methods. Lake Hefner near Oklahoma City, Okla., was chosen for this purpose after an extensive survey of western reservoirs and lakes. Studies were made in 1950 and 1951 in collaboration with the Bureau of Reclamation, the Weather Bureau, and the Department of the Navy. As a result of that investigation it was discovered that good estimates of evaporation can be made by using an empirical equation involving standard meteorological observations together with the surface-water temperature of the lake (embodying some of the principles of the mass-transfer theory), or by using the energy-budget method for periods of 7 days or longer. The Cummings Radiation Integrator was found to be a satisfactory instrument for use with the energy-budget method. Coefficients for evaporation pans were found to have a pronounced seasonal variation so that they are considered useful only for determining annual evaporation.

The results of the Lake Hefner investigation were sufficiently conclusive to permit the determination of evaporation from Lake Mead, the original incentive for the Lake Hefner experiment. These studies, however, led to investigation of new problems, one of which is determining evaporation from reservoirs in advance of construction. Model studies, involving a model of Lake Hefner in the wind tunnel at Fort Collins, Colo.,.are being made to see if such an approach will solve the problem. Also, a pilot study is being made to see if heat-budget and mass-transfer methods can be used to determine water losses from land areas, including transpiration as well as evaporation. Other studies on various phases of evaporation are planned, but field work has not yet begun.

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Developed and Potential Water Power of the United States and Other Countries of the World

THE development of water power in the United States as well as in the entire world has shown a phenomenal increase since 1920. At that time data on the installed capacity of water-power plants, with estimates of the potential water power available, were first compiled by the Geological Survey and published by the Department of the Interior in *World Atlas of Commercial Geology,* Part II: *Water Power of the World.* The average annual rate of increase in installed capacity from 1920 to 1945 was fairly uniform. The rate of increase has been considerably greater since 1945, and scheduled completions for the next few years indicate that it will continue into the future. The installed capacity of water power plants for the United States and the entire world for various years starting with 1920 and percentage comparisons are shown in Table 1.

The development of water power for the world as a whole increased 500 percent from 1920 to 1952, whereas the increase for the United States was slightly over 400 percent. This difference is naturally due to the fact that the United States had made more progress in water-power development than had the other coun-

TABLE 1. Installed capacity of water power plants of the world and of the U.S. compared, 1920–52.

Year* (Dec.)	Total capacity of water-power plants (in thousands of hp)		Comparison with 1920 (%)	
	World	U.S.	World	U.S.
1920	23,000	7,500	100	100
1923	29,000	9,087	126	121
1926	33,000	11,177	143	149
1930	46,000	14,885	200	198
1934	55,000	16,075	239	214
1936	60,000	17,120	261	228
1938	63,900	17,949	278	239
1940	69,400	19,000	302	253
1941	71,600	19,816	311	264
1945	77,800	24,223	338	323
1947	86,900	24,500	378	327
1950	101,000	27,500	439	367
1952	115,600	31,000	502	413

* Years when estimates were made by U.S. Geological Survey.

tries of the world prior to 1920. Development in all countries is continuing at an unprecedented rate.

Water-power developments now in progress will total more than 5,000,000 hp in the next few years in the United States and more than 3,000,000 hp in Canada. The Union of Soviet Socialist Republics reportedly has plants under construction that will total 6,000,000 hp. Developments are in progress in Australia that will total more than 1,000,000 hp. In China consideration is being given to a project on the Yangtze River that would have a capacity of about 15,000,000 hp.

The capacity of water-power plants (1952) and the estimated potential water power for the various continents are listed in Table 2.

Africa is seen to have the largest potential power and the smallest installed capacity of the continents. Actual development of much of this power presents almost insurmountable obstacles owing to inaccessibility and remoteness from possible points of use. Much of Asia's potential power is on large northern rivers, also remote from possible markets.

TABLE 2. Water-power plants and potential water power.

Continent	Capacity of water-power plants, 1952 (in thousands of hp)	Potential water-power based on ordinary minimum flow (in thousands of hp)
Africa	715	250,000
Asia	14,392	156,000
Europe	48,516	64,000
North America	46,430	90,000
Oceania	1,778	23,000
South America	3,962	62,000
World (approx.)	115,793	645,000

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Total-Intensity Magnetic Anomalies of Three-Dimensional Distributions by Means of Experimentally Derived Double Layer Model Fields

MODEL experiments have been used for many years in magnetic interpretation because the magnetic fields of geologic bodies can be determined with greater facility experimentally than by calculation. Experiments in the past have usually dealt with the vertical and horizontal components of the magnetic field. We recently completed a series of experiments at the Naval Ordnance Laboratory wherein the total magnetic intensity in the direction of the inducing field was measured for a series of models to devise a rapid method for the interpretation of total-intensity aeromagnetic maps.

Any irregularly shaped magnetic body may be approximated by the proper arrangement of prismatic rectangular slabs of constant thickness and varying horizontal dimensions. The contoured total-intensity magnetic fields of such slabs buried at different depths and subjected to inducing fields of varying inclinations may be determined experimentally. It can be shown that for sufficiently small areas, the direction of the anomalous field may be assumed to be codirectional with the earth's ambient field. Consequently, for an irregular magnetic mass distribution, the field may be obtained by superimposing the appropriate contoured maps and adding numerically the effects at each point.

Experiments were conducted in a building constructed entirely of nonferrous materials. In this building, Helmholtz coils are used to establish a field simulating the earth's magnetic field at the center of the system. With the aid of a potentiometer arrangement, this can be done with accuracy of 10 gammas. Models constructed of a uniform mixture of 1 part powdered magnetite and 2 parts plaster of Paris by volume are placed on a fixed tray in the center of the system. Below the model is a detector, placed on a vertical tower and capable of moving in either a north-south or east-west direction. The detector is a second harmonic flux-gate type magnetometer. The signal is amplified and recorded as a continuous profile as the detector is moved over the model.

The thickness of our models was 0.5 in., and the horizontal dimensions (in inches) were 5×20, 5×30, 5×5, 10×30, 10×10, 20×20, $2\frac{1}{2} \times 20$, 10×20. Fields were mapped with the long axis oriented first parallel to, then normal to magnetic north. Fields were measured in a horizontal plane for model-detector depths at intervals of 0.5 in. between minimum and maximum