

## OUR ASTRONOMICAL COLUMN.

A NEW COMET.—The Astronomer Royal informs us that he has received the following telegram from Prof. O. Baeklund, director of the Pulkova Observatory:—"New comet Neujmin., 11.0 mag., February 24, 9h. 17m. Simeis M.T., R.A. 8h. 58m. 40s., declination  $16^{\circ} 24' N$ . Motion slow. Probably south." A further observation telephoned to us as we go to press is as follows:—"R.A. 8h. 58m. 29.8s., declination  $+14^{\circ} 42' 58''$ , February 27, 11h. 33.6m., G.M.T."

COMET 1915a (MELLISH).—Additional measures of the condensations in the tail of this comet are given in Lowell Observatory Bulletin, No. 70. Photographs taken with the 40-in. reflector have been measured by Mr. C. O. Lampland. Mr. E. C. Slipher made visual micrometric measures with the 24-in. refractor.

The following positions of the comet are extracted from an ephemeris given in Circular 501 of the *Astronomischen Nachrichten*:—

		12h. G.M.T.						Dec.		Mag.
		R.A. h. m. s.								
March	2	...	3	37	24	...	+ 20	56.6	...	11.7
	6	...		40	12	...	21	27.2	...	
	10	...		43	9	...	21	56.9	...	11.9

U.S. NAVAL OBSERVATORY, 1915.—We have received a copy of the report of the superintendent of this extremely active institution. The Gaithersburg Station of the International Latitude Service has been discontinued. Dr. F. E. Ross has been transferred to Washington, together with the photographic zenith tube for continuous determination of the variation of latitude.

A DAYLIGHT METEOR.—An extremely interesting account of a great meteor seen over the Chusan Archipelago during the forenoon of February 13, 1915, has been given by Capt. W. F. Tyler, R.N.R., in a paper communicated to the North China Branch of the Royal Asiatic Society (Journal, vol. xiv.). Capt Tyler's attention was directed to the matter by the report of the light-keeper at Steep Island that a man-of-war had fired an aerial torpedo which nearly hit the tower. The combined observations from a number of adjacent islands and from Shanghai seem to be best fitted by assuming the meteor followed a strongly curved path, at first travelling a little east of north, and finally moving towards the south-east. The meteor was seen to fall into the sea near Video Island, and a violent explosion was heard over a very wide area. It is notable that exceptional meteoric displays have been recorded about this date in previous years.

A TRANSNEPTUNIAN PLANET.—The first number of the first volume of the Memoirs of the Lowell Observatory deals with this alluring subject. Although the cometary evidence which has been held to indicate the existence of an additional member of the solar system may be open to other interpretation, yet it may be confidently predicted that extended knowledge of the motions of the known outer planets will ultimately settle the matter if, that is, the hypothetical body, or bodies, exist. It is interesting to compare the material Dr. Lowell finds available with that which led to the capture of Neptune. In the first place, the latter has not yet been known long enough to enable its theory to be developed with the accuracy required as a basis of a search for a source of perturbation, hence instead of the planet next in the series, recourse must be made to the antepenultimate Uranus. Then, secondly, the residuals given by Gaillot's theory of Uranus do not exceed  $4.5''$  at any point of its path (1709–1910), whilst in 1845 Uranus showed an unexplained discrepancy amounting to  $133''$ . A comparison of the present residuals, small though they be, with

the probable errors of observations, shows that they are too large to be due to the latter. By a lengthy process of trial by error Dr. Lowell shows that the hypothesis of a single outside perturbing body can reduce the residuals 71 per cent., or, including errors of observation, by 90 to 100 per cent. Two solutions are found to be equally indicated, one with the unknown situated (July 0, 1914) in heliocentric longitude  $84.0^{\circ}$ , for the other in  $262.8^{\circ}$ . The distances, masses, and eccentricities are closely alike, being about forty-four times the earth's distance from the sun,  $1/50,000$  of the sun's mass, and an eccentricity about 0.2, indicating a visibility of 12–13 magnitude, and a disc greater than  $1''$  in diameter.

ARTIFICIAL IRRIGATION IN THE WESTERN STATES OF NORTH AMERICA.<sup>1</sup>

THE hydrological department of the United States Geological Survey finds nowhere, perhaps, so important and fruitful a field of operations as in the great tract of country which lies west of the 100th meridian of west longitude. The difficulties attending the agricultural development of regions in which the rainfall is so scanty as to be almost negligible are sufficiently obvious, but the lack of adequate supplies of water is no less felt for mining and industrial purposes, to say nothing of ordinary domestic requirements. Hence arises the necessity for a close and searching investigation into all such sources as are actually available, and the conservation of supplies from streams and wells, so that they may be utilised to the best advantage, with the reduction of waste and loss to a minimum.

Such are the conditions prevailing on the south-eastern portion of the State of Nevada. Large areas of fertile soil lie idle for want of moisture to make them productive, and very little vegetation survives, unaided, the long periods of drought. The average annual precipitation of rain at seven gauging stations in different localities ranges from 3.42 to 11.99 in. When a rainfall does occur, it often takes the form of a cloudburst, in which a large quantity of water falls on a small area in a very short space of time. Much consequently is lost. The majority of the upland streams, moreover, disappear in the alluvial slopes at the foot of the mountains, and only flood waters from heavy rains reach the central valleys. Wells and springs, therefore, constitute some of the most important sources of supply, and they are found to give the best yield in the unconsolidated sedimentary deposits which partly fill the structural basins of the district. The lower indurated strata, forming what is called the "bed-rock," are much less productive. These lower formations are usually hard, compact, and impervious layers, representative of various systems, mostly sedimentary, but with some igneous intrusions. They serve the useful purpose of confining the water which enters the "valley-fill," and of preventing its downward escape.

Tularosa Basin, in New Mexico, with an area of 6000 square miles, is another arid region with similar climatic conditions. The sky is generally clear, the atmosphere dry, and the average rainfall in the lower

"Ground Water in South-Eastern Nevada." By Everett Carpenter (Water Supply Paper 265.) Pp. 86, with diagrams and 5 plates.

"Geology and Water Resources of Tularosa Basin, New Mexico." By O. E. Meinzer and R. F. Hare (Water Supply Paper 343.) Pp. 316, with diagrams and 10 plates.

"Springs of California." By Gerald A. Waring (Water Supply Paper 338.) Pp. 410, with diagrams and 13 plates.

"Ground Water for Irrigation in the Sacramento Valley, California." By Kirk Bryan (Water Supply Paper 375 A.) Pp. 49, with diagrams and 2 plates.

"Ground Water Resources of the Niles Cone and Adjacent Areas, California." By W. O. Clark (Water Supply Paper 345 H.) Pp. 43, with diagrams and 9 plates.

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parts is only about 10 in. per annum. The valley possesses considerable mineral wealth, including gold, copper, lead, iron, turquoise, coal, and gypsum. The metalliferous deposits, especially gold, have been extensively worked. But, from an agricultural point of view, the district has been practically neglected. Vast tracts of arable land, capable of producing valuable crops, lie uncultivated for lack of treatment. In any system of development, artificial irrigation would, of course, be a necessity, but there are abundant stores of underground water available for exploitation and use. As in south-eastern Nevada, these supplies are more prolific in the "valley-fill" than in the "bed-rock." The most important sources are the sand and gravel deposits, which lie in irregular lenticular masses at different depths in different localities. The Cretaceous rocks, however, underlying the eastern portion of the basin, yield a sufficient supply for domestic and cattle-raising purposes.

Further to the west lies the great State of California, second only to Texas in point of size, and characterised by a remarkable physiographical diversity. Thus it encloses both the highest and the lowest levels in the Union, viz., 14,501 ft. above the sea (Mount Whitney), and 276 ft. below the same datum (Death Valley). There are equally diverse hydrographic features. In the southern deserts is to be found the extreme of aridity: a rainfall which averages less than 3 in. per annum, and, in some years, is merely a trace; whereas, in the north-west, there is very heavy precipitation, amounting to an annual average of close on 100 in. at certain stations. Mr. Waring's paper contains a very full account of the natural springs scattered throughout the State, with an interesting study of their occurrence and yield. The hot springs are perhaps the most remarkable class, and these include all springs having a temperature higher than about 90° F. Other groups of springs include carbonated springs, sulphur springs, saline springs, magnesian springs, and iron springs, each class named after the constituent which marks the flavour and character of the water. One curious spring is the so-called "poison spring" on the western border of Death Valley, which is an arm of the Colorado Desert. It yields a salty water, impregnated probably with sulphates, producing a strong feeling of nausea in anyone imbibing it. Other popularly described "poison" springs are believed to contain arsenic, but of this there is some doubt, as arsenic is a rare constituent of water and seldom present in measurable amount.

The most prominent topographical feature of California is the Great Central Valley, 16,000 square miles in area, flanked on each side by mountain ranges running parallel with the coast. One portion of this is the Sacramento Valley, a broad and fertile plain lying between the Sierra Nevada and the Coast Range. It is a district unmistakably adapted to agricultural pursuits, possessing climatic conditions of the most favourable kind. The winters are moderate, and the rainfall, which averages from 20 to 25 in. annually, is concentrated, in a large measure, within the five months of their duration. The orchard industry has acquired special prominence. All deciduous fruits bear heavy crops, being rarely damaged by frost, while the more delicate varieties, such as apricots, almonds, olives, etc., flourish in suitable localities. Under normal conditions it is quite unnecessary to resort to artificial irrigation, but, as a means to the more extended and intensive cultivation of ground crops and the inclusion under operation of certain lands at present only available for grazing, the study of water storage and distribution is receiving attention. The ground water is principally contained in the uppermost alluvial deposits, and the valley is remarkable

for the large area in which the water-level stands near the surface of the ground. The alluvium is of two periods: an older deposition dating from the Pliocene epoch and continuing into the Pleistocene, and a later deposit of more recent formation. This latter is the most productive water-bearing stratum, and consists largely of sands and gravels in an uncemented condition. The total quantity of ground water in the valley is undoubtedly very considerable, and the application of irrigation from this source presents great possibilities of development.

Adjacent to the Sacramento Valley, on the eastern side of San Francisco Bay, is situated a somewhat notable cone of alluvial deposit, built up by a neighbouring creek, and called, from its proximity to a town of the name, Niles Cone. The cone proper is 11,800 acres in extent, but a marsh tract adds 9000 acres to the area forming the ground-water district covered by Mr. Clark's report. The creek from which the cone derives its origin is Alameda Creek, at the outlet of the Santa Clara Valley. This receives the drainage of 640 square miles of mountains and interior valleys. The alluvial deposits have been brought down by streams during periods of irregular flow. The upper layers belong to the Pleistocene and Recent series of the Quaternary system; the lower strata form part of the Orinda formation in the Pliocene series. Below these fresh-water deposits lie shale and sandstone of the Cretaceous, and, possibly, of the Jurassic periods. The development of artificial irrigation is proceeding rapidly, and numerous wells have been sunk during the past few years, but the limit of yield from the ground water has almost been attained, and any further supplies will have to be obtained by conserving the large quantities of flood water which have hitherto been allowed to run to waste. B. C.

#### SOME RECENT STUDIES ON PROTOZOA AND DISEASE.

DR. J. W. SCOTT MACFIE describes in *Annals of Tropical Medicine and Parasitology* (vol. ix., No. 4) a number of interesting protozoa from Accra, West Africa. He records the occurrence of a piroplasm—*Nuttallia decumani*, n. sp.—in the blood of brown rats, and gives an account of a case of amoebic dysentery in a monkey (*Cercopithecus*), in which numerous *Entamoeba* were present, together with a vast number of minute spirochaetes. He designates as a new variety (var. *equinum*) a strain of *Trypanosoma congolense*, chiefly on the ground that in many of the trypanosomes the trichonucleus lies near the anterior end. The clinical aspect of the disease produced by this trypanosome in the original host—a mare—was also peculiar in that there appeared on the skin of the body raised disc-like patches or plaques, which, however, disappeared after about three days. Dr. Macfie also records observations on two mules suffering from a form of trypanosomiasis clinically resembling acute dourine, and states that in these cases infection by coitus—the usual method of transmission of this disease—may be excluded with certainty.

An account of researches by Drs. Fantham and Porter on induced herpetomoniasis in birds appears in the same number of the *Annals*. Water-scorpions and gnats, in the intestine of which the flagellate parasite *Herpetomonas* was present, were fed to birds—canaries, sparrows, and martins. A fatal infection of the birds ensued, and herpetomonads, flagellate and non-flagellate, were found in the internal organs (liver, spleen, bone-marrow, etc.). The disease ran either an acute or a chronic course. In acute cases the flagellate form of the parasite was more common in the birds at death, while in chronic cases the non-