large enough, a modern village, and four, possibly five, sites of former villages. The deserted villages, according to Dr. Stein, were abandoned approximately in 1840 A.D., 1300 A.D., 800 A.D., 300 A.D. (?), the sites being successively older as one goes farther into the desert. The 1840 village was abandoned because, after a number of years of increasing drought, no water reached the village for seven years during the winter, and the supply in summer was so scanty as to cause suffering. Wells had to be dug, and field after field abandoned. Finally the whole village moved at one time to the sandier soil farther upstream, where the water had had less opportunity to become lost in the ground. A well-known tradition assigns the same cause to the abandonment of the more remote village of 1300 A.D., or whatever the date may be. Historical records prove that this village was conquered and sacked at the time of the Mohammedan invasion, but was not abandoned in spite of the calamity, although the inhabitants of some of the neighbouring villages fled northward. There is strong reason for believing the tradition to be founded on fact. The 800 A.D. and 300 A.D. villages do not appear to have been abandoned because of wars or calamities, as appears from the care with which almost everything of any intrinsic value was removed. It is not improbable that they too may have been abandoned because of increasing desiccation. The large areas of dead jungle and scrub here and elsewhere support this hypothesis, for even if the towns were abandoned by reason of wars or calamities, their previous water-supply would be disseminated somewhere in the region, and would support the ordinary vegetation of the desert border. The frequent presence of dead jungle in places where human agency appears to have played no part either in bringing or diverting the water-supply, is even more significant. The facts which have just been outlined, and others like them, are not yet sufficient to prove the gradual desiccation of Central Asia during historical times, but they at least add a keen interest to the further study of the question which I mean to carry on further east.

"Mr. Barrett and I have now finished our work together, and are conducting separate expeditions. He expects to remain on the southern border of the Tarim basin for some time longer; I expect to spend the winter in the Lob Nor region, and to reach Turfan in the spring."

LONGITUDE BY TELEGRAPH ROUND THE WORLD.

With the opening of the Trans Pacific cable in 1903, it became possible, for the first time, to obtain the telegraphic difference of longitude between San Francisco and Manila by way of Honolulu and the islands of Midway and Guam, and thus complete the circuit of the Earth. In anticipation of the opportunity thus afforded, the United States Coast

and Geodetic Survey lost no time in making preparations for this important work, and by December, 1903, the matter was taken in hand in earnest, Mr. Edwin Smith of this survey being entrusted with the arrangements.

First of all, the instruments and apparatus for automatically recording the signals had to be carefully considered. A method had been successfully employed by the Canadian and English observers in determining the difference of longitude between Greenwich and Montreal in 1892, and, Mr. Smith having obtained particulars of this, similar recording apparatus was constructed at the Coast and Geodetic Survey Office, and was found to be entirely satisfactory throughout the operations.

Mr. G. C. Ward, vice-president and general manager of the Commercial Pacific Cable Company, entered heartily into the project, granting free use of the cable, and issuing instructions to the superintendents at the various stations in the Pacific to render all the assistance in their power.

Mr. Smith had as his colleague in this undertaking Mr. Fremont Morse, also of the United States Coast and Geodetic Survey, and everything being ready, the first section of the work, that between San Francisco and Honolulu, was completed without much difficulty. Observations were taken and signals exchanged first in April and then in June, the interval between the dates being due to the time necessary for the exchange of observers.

As there seemed a possibility of getting signals through direct between Honolulu and Guam without using the intermediate station at Midway island, it was considered worth while to make the attempt, especially as the latter is not easily accessible; and with this object, Mr. Smith started from Honolulu, and arrived at Guam on July 14. Here, however, many difficulties were met with, and it became evident that no satisfactory signals between Honolulu and Guam, with the cables joined at Midway, could be obtained, except, possibly, by the use of a voltage so great that the cables would be endangered, and reluctantly the idea of leaving out Midway island station had to be abandoned.

The next section to be undertaken was that between Guam and Manila, and, Mr. Morse having proceeded to the latter place, the difference of longitude was determined between September 8 and 16. Owing to difficulties of transport between these two places, an exchange of observers was found to be impossible.

There still remained the sections between Guam and Midway and Midway and Honolulu to be connected to complete the work, and after many delays, owing to transport difficulties and bad weather, Mr Morse reached Midway early in November, and the longitude determinations between Midway and Guam were made during the latter part o

that month and the early part of December. Subsequently, Mr. Smith having returned to Honolulu, the last section, between Midway and Honolulu, was completed during February and March, 1904.

In his account of these operations,* Mr. Smith gives most interesting particulars and details, from which it is clear that every effort was made to render the results as accurate and complete as possible, special attention being paid to personal equation and other refinements. The following is a table of the final results in longitude, together with the probable error :—

	h.	m.	sec.	sec.
Honolulu transit, west of Greenwich	10	31	27·732	± 0·056
Midway transit, west of Greenwich	11	49	30·952	± 0·057
Guam transit, east of Greenwich	9	38	35·466	± 0·058
Manila transit, east of Greenwich	8	3	52·202	± 0·059
Manila cathedral dome, east of Greenwich	8	3	52·426	± 0·059

These results depend upon the longitude of the transit at San Francisco (1903) being $8^h\ 9^m\ 48^s{\cdot}809$, with a probable error of $\pm\ 0^s{\cdot}055$, which is the result of previous trans-continental triangulation and telegraphic connection with Greenwich.

The actual differences of longitude between the Pacific stations were found to be as follows :—

	h.	m.	sec.	sec.
Honolulu transit, west of San Francisco transit ...	2	21	38·923	± 0·008
Midway transit, west of Honolulu transit	1	18	3·220	± 0·015
Guam transit, west of Midway transit	2	31	53·582	± 0·010
Manila transit, west of Guam transit	1	34	43·264	± 0·010

At the end of his report Mr. Smith gives an interesting account of the previous determinations of longitude through Europe and Asia to Manila, and it is instructive to compare the results of these earlier determinations with that now obtained quite independently by the western route and the new Pacific cable. The longitude of Manila cathedral dome had been telegraphically obtained previously by two different lines—*viâ* Russia and Siberia to Vladivostok, and by the southern line through Persia and India. The first gives $8^h\ 3^m\ 52^s{\cdot}697 \pm 0^s{\cdot}157$, and by the second, $8^h\ 3^m\ 52^s{\cdot}238 \pm 0^s{\cdot}061$. The longitude accepted by the United States Navy previous to the recent determination, depending on Madras being $5^h\ 20^m\ 59^s{\cdot}42$, was $8^h\ 3^m\ 52^s{\cdot}42$ E., which differs only by $0^s{\cdot}006$ from the result recently obtained by the Pacific route. This must be considered a most remarkable agreement.

In addition to a great deal of tabular matter and descriptive text, Mr. Smith, in his report, gives full-page plates of the observatories erected at the different stations, as well as of the instruments and automatic recording apparatus used. There is also a sketch-chart showing the position of the stations.

---

* Appendix No. 4 to U.S. Coast and Geodetic Survey Report for 1904.