

## REPUBLIC OF YEMEN

Around 1000 *BC* the region of present Yemen was ruled by three successive civilizations: the Minaean, the Sabaean, and the Himyarite. These three kingdoms all depended for their wealth on the spice trade, consisting mainly of frankincense and myrrh. By the 11<sup>th</sup> century *BC*, land routes were greatly improved throughout Arabia by using the camel as the beast of burden. Frankincense was carried from its production center at Qana (now Bir'Ali) to Gaza. The chief incense traders were the Minaeans, who established their capital at Karna (now Sadah), before the Sabaean era in 950 *BC*, which lasted for about 14 centuries. The region was invaded by the Romans in the first century *AD*; by the 6<sup>th</sup> century *AD*, it was conquered first by the Ethiopians (*PE&RS*, March 2003), and then by the Persians. The region converted to Islam in the 7<sup>th</sup> century. North Yemen became independent of the Ottoman Empire (Turkey) in 1918. The British had set up a protectorate area around the southern port of Aden during the 19<sup>th</sup> century, but withdrew in 1967 from what had become South Yemen. After two decades of hostilities, the two countries were formally unified as the Republic of Yemen in 1990.

Yemen is bordered by Saudi Arabia on the north (1,458 km), Oman on the east (288 km), the Arabian Sea and Gulf of Aden to the south, and the Red Sea to the west (1906 km). Slightly larger than twice the size of Wyoming, the country is comprised of a narrow coastal plain backed by flat-topped hills and rugged mountains with dissected upland desert plains in the center that slope into the desert interior. The lowest point is the Arabian Sea and the highest point is Jabal an Nabi Shu'ayb at 3,760 m.

Original classical triangulation of Western Aden was done by the British Survey of India in the early 20<sup>th</sup> century. The first large-scale map series, based on ground surveys, was published in 1917. Later updated, the Aden GSGS 3879 series at 1:126,720 scale was published as a polychrome series in 1930. Carl Rathjens and Herman von Wissmann published the *Karte des Reisegebiets in Jemen* (Map of the Region Traversed in Yemen) in 1934. There was no grid on the map at 1:100,000 scale, and it covered a limited area of Yemen between  $\alpha$ an'ā' and the coast. The three-part polychrome map was based on road surveys,

supplemented with diaries, sketches, and maps from other travelers. Relief was represented by form lines or hachures.

In 1925, the British Survey of India established the Aden Zone Lambert Conical Orthomorphic grid where the latitude of origin  $\phi_0 = 15^\circ$  N, central meridian  $\lambda_0 = 45^\circ$  E, scale factor at the latitude of origin  $m_0 = 0.999365678$ , False Easting = 1,500 km, and False Northing = 1,000 km. This typical "British Grid" had its limits of zone listed as "North: 150,000 meter Northing grid line of the Mecca-Muscat Zone (Lambert Conical Orthomorphic projection), East: Meridian of  $60^\circ$ E, South: From meridian of  $60^\circ$ E, southwest along loxodrome defined by the points  $14^\circ 30'$  N,  $56^\circ$  E, and  $11^\circ 30'$  N,  $44^\circ$  E., West: Loxodrome from  $44^\circ$  E,  $11^\circ 30'$  N toward  $19^\circ$  N,  $39^\circ$  E, to intersection of 150,000 meter Northing grid line of Mecca-Muscat Zone with the loxodrome." The ellipsoid of reference is the Clarke 1880 where  $a = 6,378,249.145$  m and  $1/f = 293.4663077$ . Curiously, no datum was listed by the British General Staff, Geographical Section (GSGS). However, reading the Survey of India Triangulation Dossiers reveals that all British chains in the region were based on the original Nahrwan Datum of Iraq where  $\Phi_0 = 33^\circ 19' 10.87''$  N,  $\Lambda_0 = 44^\circ 43' 25.54''$  E, and the orientation is based on the azimuth from South End Base of Nahrwan ("1M") to "2M" as  $\alpha_0 = 169^\circ 04' 08.2''$  from south. In my opinion, the original classical datum of Yemen ("Aden Datum of 1925") is actually the British-observed Nahrwan Datum. A test point provided by the U.S. Army Corps of Engineers, Lake Survey Unit in 1943 for Aden Zone is  $\phi = 13^\circ 53' 46.728''$  N,  $\lambda = 37^\circ 37' 19.732''$  E,  $X = 703,075.269$  m,  $Y = 891,245.290$  m,  $\theta = -1^\circ 54' 34.3032$ , and  $m_0 = 0.91412282$ .

Numerous map series of Aden and  $\alpha$ an'ā' were produced by the British and U.S. militaries in the period between 1950 and 1961. Scales varied from 1:10,000 to 1:100,000. Other datums reported to exist include Kamaran (Island) Datum of 1926-1927, Ras Karma (Island) Datum, Socotra (Island) Datum of 1957, and Socotra (Island) Datum of 1964-1965. All of these island "astro" datums are presumably referenced to the Clarke 1880 ellipsoid.

A curiosity in large-scale map projections was developed by the U.S. Geological Sur-

vey when a mapping project was completed of  $\alpha$ an'ā' in the 1960s. The  $\alpha$ an'ā' Azimuthal Equidistant Grid System was defined by the latitude of origin  $\phi_0 = 15^\circ 37' 22''$  N, central meridian  $\lambda_0 = 42^\circ 59' 32.25''$  E, scale factor at the latitude of origin  $m_0 = 1.0$ , False Easting = 40 km, and False Northing = 20 km. The International ellipsoid was chosen for the grid, and the datum was presumably ersatz.

Yemen and Oman established their boundary in an 01 October 1992 agreement consisting of straight-line segments connecting eight turning points defined on the WGS84 Datum. The eighth point is a tri-point with Saudi Arabia. On 18 April 2001, Yemen signed a cooperation agreement based on the 1999 International Tribunal resolution of the Permanent Court of Arbitration, the Hague, the Netherlands. In 2000, Yemen and Saudi Arabia agreed to a delimitation of their common border.

Large-scale local topographic maps of Yemen are controlled by the government. However, complete topographic coverage of the country is available from commercial map sellers worldwide in the form of Russian military mapping at the scales of 1:200,000 and 1:100,000. Considering the availability of these recent up-to-date Russian maps and the phenomenal accuracy achieved nowadays with shirt-pocket-sized consumer-grade GPS receivers, such secrecy of the Yemeni government is merely restricting the economic development of their own nation.



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