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The Greeks and the Phoenicians settled Spain on the southern and eastern coasts. The Mediterranean coastal region was ruled by Carthage, which ceded it to Rome in 201 B.C. Invaded by Vandals in 409 A.D., the Moors were expelled from Granada in 1492. Spain occupies the greater part of the Iberian Peninsula, and the Kingdom claims the Balearic and Canary Islands. Most of the peninsula is plateau – averaging 1,250 meters (4,100 feet).

Spain’s cadastre began in 1854, but the Law of Cadastro established the way to perform the work in 1906. This was essentially a rural method for taxation until 1964 when urban areas of the Kingdom were brought into the cadastre.

The Spanish first-order triangulation of 1858-1885 consists of ten principal arcs: the meridional arcs of Salamanca, Madrid, Pamplona and Lerida; the parallel arcs of Palencia, Madrid and Badajoz; and the diagonal arcs of the North, East and South coasts. The origin of the Madrid Observatory Datum of 1853 is \( \Phi_o = 40^\circ 00' \) North, a Scale Factor at Origin \( m_o = 0.9988085293 \) and a Central Meridian \( \lambda_o = 03^\circ 41' 14.546^\prime \) West of Greenwich. The False Northing and False Easting were both equal to 600 km. That Grid is still in use. However, in 1880, the Military adopted a bonne projection for the Itinerario Militar (military route map) with a Latitude of Origin \( \phi_o = 40^\circ 45' \) North, a Scale Factor at Origin \( m_o = 1.0 \) and a Central Meridian \( \lambda_o = 04^\circ 26' 14.55^\prime \) West of Greenwich. That bonne base remained in use until 1951 when the UTM was adopted for all military applications in Spain.

During World War II, the Iberian Peninsula Lambert tangent Zone was used by the Allied Forces. This Grid had a Latitude of Origin \( \phi_o = 40^\circ 00' \) North, and a Central Meridian \( \lambda_o = 03^\circ 41' 14.546^\prime \) West of Greenwich. The False Northing = 600 km, and the False Easting = 530 km. A later triangulation densification in 1930-33 was observed with Wild T3 theodolites. During the war, the Germans developed a series of computations for the Spanish Triangulation Network referenced to the Clarke 1880 ellipsoid. After the war, those German tables were useful in the re-computation of the classical triangulation of the Kingdom onto the European Datum of 1950 (ED50) which was referenced to the International Ellipsoid. The subsequent transformation of the Spanish Net to ED50 was based on a two-step two-dimensional Helmert transformation. The initial step computed by the Axis (Germans) was still on a Lambert Conformal Conic projection, but referenced to the Clarke 1880, which was the standard for France. That series of collocated points that started computations in the Pyrenees Mountains was continued into a substantial portion of the Iberian Peninsula. After the war, the U.S. Army Map Service decided that the best way to merge the Madrid Observatory Datum of 1858 into the new ED50 was to use the existing German data as an intermediate step. In computing the new French datum values of the Spanish triangulation, use was made of the German adjustment of 1938. Values of the New Triangulation of France (NTF) were available for the following 11 Spanish triangulation stations: Forceral, Canigou, Licasus, Rouge, Cabére, Maupas, Anie, Orhi, Baigura, La Rune, and Biarritz. Computations to the Madrid Datum of 1858 were performed by V.U.K.A. 631 (April 1943) and by Kriegskarten und Bemessungsamt, Paris (August 1943).

Other Datums of Spain include San Fernando Observatory where: \( \Phi_o = 36^\circ 27' 54.6^\prime \) North, \( \lambda_o = 06^\circ 12' 17.8^\prime \) West of Greenwich. Another version of the same point is where: \( \Phi_o = 36^\circ 27' 41.52^\prime \) North, and \( \lambda_o = 06^\circ 12' 19.5^\prime \) West of Greenwich. This same point on the “Salamanca Datum” is: \( \Phi_o = 36^\circ 27' 54.65^\prime \) North, and \( \lambda_o = 06^\circ 12' 18.00^\prime \) West of Greenwich.

Pico de las Nieves Datum of 1934 in the Canary Islands is where the origin is: \( \Phi_o = 27^\circ 57' 41.273^\prime \) North \( \pm 0.130^\prime \), and \( \lambda_o = -15^\circ 34' 10.524^\prime \) West of Greenwich \( \pm 0.380^\prime \). The defining azimuth was observed to station Isleta as: \( a_o = 212^\circ 34' 48.30^\prime \) from south, and the elevation is 1949.14 m. It is referenced to the International ellipsoid of 1909 (Madrid 1924) where \( a = 6,378,388 \) meters and the reciprocal of flattening \( (1/f) = 297.13 \). Also found on the Canary Ise Abona Datum that is referenced to.

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the International 1909 ellipsoid. The origin of that Datum is:
\(\Phi_o = 28^\circ 08' 22.93''\) North ±0.102", and
\(\Lambda_o = -16^\circ 25' 01.92''\) West of Greenwich ±0.105". The defining azimuth was observed to station Roja as:
\(\alpha_o = 221^\circ 48' 27.48''\), and the elevation is 16.82 m. The Royal Spanish
“Servicio Geografico del Ejercito” (Army Map Service) Grid of 1945 for
the Canaries is on the International 1909 ellipsoid. The Latitude of Origin
\((\phi_o) = 28^\circ 30'\) North, and a Central Meridian \((\lambda_o) = -12^\circ 00'\) West of Madrid
(therefore, \(\lambda_o = -15^\circ 41' 14.546''\) West of Greenwich). The Scale Factor at
Origin \((m_o) = 0.9999244799\), and the False Northing (FN) and the False
Easting (FE) = 400 km.

Interestingly, the British Grid system for the Canary Islands used during
WWII by the Allies was also based on a secant Lambert Conformal Conic projection. The Latitude of Origin \((\phi_o) = 27^\circ 00'\) North, and a
Central Meridian \((\lambda_o) = -17^\circ 00'\) West of Greenwich. The Scale Factor at
Origin \((m_o) = 0.9993817\), the False Northing (FN) = 100 km, and the
False Easting (FE) = 200 km. This Grid was referenced to the Clarke 1880 ellipsoid presumably because the Canary Islands are so close to
Africa. That ellipsoid is/was the (British) standard for that continent. (Some of the WWII-era British
Grids were based on ersatz Datums “cooked up” for reasons of expediency during the war.)

The Balearic Islands in the Mediterranean Sea are said to be on the
Madrid Datum of 1858, but I do not think that is true. Ten years later,
station Mola was observed for the Balearic Islands Datum of 1868
where: \(\Phi_o = 38^\circ 39' 53.17''\) North, and
\(\Lambda_o = +5^\circ 13' 19.94''\) East of Madrid
(therefore, +1° 32' 05.394” East of Greenwich). The longitude is also
defined as –0° 48' 11.26" West of Paris, which leaves a discrepancy of
2.71" in Longitude between Greenwich and Paris. This is not a large
error for an “Astro” shot done on an island in 1868, but it is quite large
for the relation between two national observatories. The defining
azimuth was observed to station Furnas as: \(\alpha_o = 177^\circ 39' 11.03''\) from
south, and to station Camp Vey as: \(\alpha_o = 160^\circ 15' 40.48''\) from south. The
elevation of Mola is 192.25 m, and, of course, the ellipsoid of reference
is the Struve 1860.

NIMA lists the three-parameter datum shift from the European Da-
tum 1950 (in Spain) to WGS84 as: \(\Delta X = -84m \pm 5m\), \(\Delta Y = -107m \pm 6m\), \(\Delta Z = -120m \pm 3m\), and is based on an
18-station solution.