

Grids & Datums

GEORGIA

by Clifford J. Mugnier, C.P., C.M.S.

“The Georgians know themselves as Kartvelebi, tracing their origins to Noah’s great-great-grandson Kartlos. In classical times the two principal kingdoms were Colchis in the west (legendary home of the Golden Fleece and site of Greek colonies) and Kartli (also known as Iveria or Iberia) in the east and south, including some areas in modern Turkey and Armenia” (*Lonely Planet, 2012*).

“Georgia’s recorded history dates back more than 2,500 years. Georgian, a South Caucasian (or ‘Kartvelian’) language, unrelated to any outside the immediate region, is one of the oldest living languages in the world and has its own distinct alphabet. Located in the picturesque Mtkvari River valley, Georgia’s capital, Tbilisi, is more than 1,550 years old. In the early 4th century, Georgia became the second nation in the world to officially adopt Christianity.

“The independent Republic of Georgia was established on May 26, 1918, in the wake of the Russian Revolution. Georgia became a Soviet Socialist Republic the following year. During the Soviet period, Georgia was one of the wealthiest and most privileged republics, and its Black Sea coastline was a popular holiday destination for the Soviet elite. On April 9, 1991, shortly before the collapse of the Soviet Union, the Supreme Council of the Republic of Georgia declared independence from the U.S.S.R.” (*Background Note, U.S. Department of State, 2012*).

Bordered by Armenia (164 km), Azerbaijan (322 km), Russia (723 km), and Turkey (252 km) (PE&RS, September 2005); Georgia is slightly smaller than South Carolina. The lowest point is the Black Sea (0 m), and the highest point is MT’a Shkhara (5,201 m). Thanks to the *CIA Factbook 2012*, the terrain of Georgia is “largely mountainous with Great Caucasus Mountains in the north and Lesser Caucasus Mountains in the south; Kolkhet’is Dablobi (Kolkhida Lowland) opens to the Black Sea in the west; Mtkvari River Basin in the east; good soils in river valley flood plains, foothills of Kolkhida Lowland.”

The first Georgian to compile an overview of the territory was Vakhushti Batonishvili who made 27 water-colored maps contained in an atlas of Europe and Georgia. The first geodetic surveys were commenced in 1818 by General Staff officers of the Tsarist Russia which included five astronomical positions, including the city of Gori.

The “First Tbilisi astronomical latitude and longitude were determined in 1828-1829 at the concrete gabion fixed in the garden of Transcaucasian Commander-in-Chief. In 1847 those data were assigned to Avlabari Astronomical Observatory and the relevant amendments were made thereto. In 1861 the first astronomical azimuth was also assessed in Georgia (*from the middle of the mark of the concrete gabion of Tbilisi Physical Observatory – along the center of the gabion arranged on the territory of Village Telet*)” (*Mrs. Ekaterine Meskhidze, Chief of International Relations, National Agency of Public Registry, Tbilisi, Georgia – personal communication 6 April 2012*).

“In 1847 the Jäderin Invar apparatus was used to measure a 9.1586 km baseline on the right bank of the Mtkvari River for a chain of figures between Tbilisi, Georgia and Ganja, Azerbaijan (*approx. 173 km – Ed.*). This chain was computed on the Walbeck 1819 ellipsoid ($a = 6,376,896\text{ m}$, $1/f_r = 302.78 - Ed.$) from 1847-1853 referenced to the Ferro meridian (*where Ferro = 17° 39' 46.02" West of Greenwich – Ed.*). By 1853 a network of 1st, 2nd, and 3rd order triangulation was adjusted and in place within Georgia. The vertical datum was established in the port city of Poti at the Black Sea tide gauge staff which was 15.2 cm below the tide gauge staff in the port city of Batumi. The specified elevation system of the Black Sea was active until 1946. From 1946 in the former Soviet Union, including the territory of Georgia, there was introduced a new Baltic elevation system from the zero of Kronstadt pole. In 1973-1977 rebalancing of the whole level net of the Soviet Union was carried out and after that it was named 1977 Baltic Elevation System which has been officially functioning on the territory of Georgia until now.

“During the 1920s, the Corps of Topographical Engineers of Tsarist Russia for the first time in Transcaucasia began creating geodetic-control-networks by triangulation method, which subsequently resulted in different-scale verst and semi-verst topographical plans” (*op. cit., Eka Meskhidze, 2012*).

In 1924 the metric system of measurement was introduced into Georgia by the Soviet Union, and network triangulation calculations were carried out in a unified system based on an origin at the Pulkovo meridian of the Pulkovo Observatory where: $\Phi_0 = 59^\circ 46' 18.55''$ North, $\Lambda_0 = 30^\circ 19' 42.09''$ East of Greenwich. The defining azimuth at the point of origin to Signal A is: $\alpha_0 = 317^\circ 02' 50.62''$. At the time, the reference ellipsoid was the Bessel 1841 where: $a = 6,377,397.155$ meters and $1/f_r = 299.1528128$. However, also at that time the cadastral land survey of Georgia was still using the centesimal system of angles, or the Grad, so the Gauss-Krüger Transverse Mercator projection was introduced, also based on the Bessel 1842 ellipsoid. In 1932, the Soviet Union introduced a new adjustment called System 32 still referenced to the Bessel ellipsoid.

“In 1939, based on one of the field expeditions of Ukrainian Southern Aerogeodetic Enterprise, which operated in Tbilisi by that time, Transcaucasia Aerogeodetic Enterprise was created first and afterwards it was reorganized into Georgian Aerogeodetic Enterprise and finally, starting from the 1960s, it was formed as 4th Closed Aerogeodetic Enterprise of Tbilisi, which was subordinate to the State Committee of Geodesy and Cartography at the Council of Ministers of the former USSR. This authority was also in charge of Tbilisi Cartographic Factory, Transcaucasia Territorial Inspectorate of State Geodetic Supervision and Tbilisi Topographic Technical School founded in 1934, which was the only specialized (specializing in topography- geodesy and cartogra-

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phy) technical school in the whole Transcaucasia. The abovementioned organizations played a major role in development of geodesy and cartography as an independent field in Georgia as well as in skilled staff training. As a result of implementation of topographic-geodetic, cartographic and photographic operations having been performed on the territory of Georgia for numerous decades, throughout Georgia there were created state geodetic horizontal-vertical control networks and different-scale state topographic maps. Training of engineering-technical staff employed in the field was carried out basically at Tbilisi Topographic Technical School, Georgian Polytechnic Institute and Tbilisi State University” (*op. cit., Eka Meskhidze, 2012*).

In 1942, the system was changed again to the “System 42” referenced to the Krassovsky 1940 ellipsoid where $a = 6,378,245$ meters and $1/f = 298.3$, and the origin remained the same at the Pulkovo Observatory. The System 42 remained the datum in Georgia until 1999. “And finally, now in Georgia a new World Coordinate System is operating, which was approved by Decree of the President of Georgia, No. 206 dated April 30, 1999, on WGS-84 Ellipsoid, in the Universal (*Transverse – Ed.*) Mercator projection.

“For oil exploration purposes, Georgia still utilizes the Coordinate System 42 (CS42), a 6° wide belt system nearly identical to the UTM except for a central scale factor of unity (1.0) and the Coordinate System 63 (CS63) which is a 3° Transverse Mercator. CS42 zone 8 is used east of 42°E longitude. The Black Sea coast falls in zone 7 where the Central Meridian is 39°E and a False Easting of 7,500,000 meters is used, and zone 8 where the Central Meridian is 45°E an a

False Easting of 8,500,000 meters is used. **From** System 42 Datum to WGS84 Datum in the area can be approximated as: $\Delta X = +18$ m, $\Delta Y = -125$ m, $\Delta Z = -83$ m, with an accuracy of 0,5 – 1 meter” (*Roger Lott, 27 February 1997*).

“In 1998 the first Georgian framework law was made ‘On Geodetic and Cartographic Activity’, the purpose of which was to adjust legal relations between state authorities and natural and legal entities engaged in the sphere of geodetic and cartographic activity. Thus, according to the basic law of the field and the provision approved by Order of the Chief of LEPL National Agency of Public Registry, the main activity of Geodesy and Cartography Service constitutes – ‘State regulation in the sphere of topography, geodesy, cartography, land cadastre and GPS survey activities and practical implementation of state administration policy’” (*op. cit., Eka Meskhidze, 2012*).

Georgia now has a network of 13 GPS Continuously Operating Reference Stations. This consists of 7 class A installations throughout the republic, and 6 class B installations around Tbilisi. Georgia became a member of EUPOS in 2011 and is connected to the EUREF Permanent Tracking Network.



The contents of this column reflect the views of the author, who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the American Society for Photogrammetry and Remote Sensing and/or the Louisiana State University Center for Geoinformatics (C⁴G).