Compilation of a 100m bathymetric grid for the Arabian Plate; Red Sea, Arabian and Oman Seas and Persian Gulf

John K. Hall and Shahar Levenson

1 Geological Survey of Israel (Retired), 30 Malchei Israel St., Jerusalem 95501 and 2 Hebrew University of Jerusalem, Givat Ram Campus, Jerusalem, Israel 91904

Last June, in Monaco, the GEBCO-Nippon Forum declared 2030 as the target for completing the unmappe d85% of the global ocean's bathymetry. While no decision was reached on the final grid resolution, 300-2000m were considered feasible. Established in 1993, GEBCO continues with periodic upgrades of its half-meter (±0.05m) global grid, but encouraging and historic finer-national grids, via ISC/AST to the Arctic, the Baltic Sea Bathymetry Database (NSDB) at 500m, and the EMODnet (European Marine Observation and Data Network) at eight-meter grids (±0.3m) will be another addition to that effort.

In a column in Hydro International in December 2015, we announced our plan to do the Red Sea at 100m, to commemorate 50 years since the International Sediment Ocean Exploration (ISEDE). In the interim, many multibeam coverage, 30 m ASTER and 6 km in the topography on land, availability of additional up-to-date national charts, and improved Satellite Derived Bathymetry (SDB) for the extensive reefs has broadened the scope to the present area from 250 to 2500 and 25 to 75°E or about 2% of the Earth’s surface. The marine area now includes the shores of 13 countries: Egypt, Jordan, Israel, Saudi Arabia, Sudan, Eritrea, Djibouti, Somalia, Yemen, Oman, United Arab Emirates (UAE), Qatar, Bahrain, Kuwait, Iraq, and Pakistan, and west-northeast Saudi. The modern and legacy charts available are shown for their five countries of origin. The Russian coverage is the most extensive and richest in bathymetric data. Estimates suggest that from the 1960s the Head Department of Navigation and Oceanography routinely collected global data from over 400 contributing vessels, equipped with deep-sea echo-sounders, good navigational control, and hydrographically trained officers. Unlike their western counterparts, these vessels often offset their tracks to provide broader coverage, and prior to the 1990s copyright was often overlapped. The British coverage is primarily for the Red Sea and Persian Gulf, reflecting heavy surveying during the World Wars and for commercial interests of the British Empire. The Red Sea charts include legacy Danish and French surveys from their support of colonists. The U.S. coverage is uneven in scale, and represents the replacement of updated printed charts by ECDIS (Electronic Chart Display and Information System). The US charts represented here are those overprinted OMEGA-3 Area of Position. The Iranian charts cover that country’s coast in the Persian Gulf and east to the Pakistan border. These charts, provided by East View Geospatial, are sometimes of low resolution but useful in an area generally off-limits since 1979.

Although this area has been the hub of marine transport for over three millennia, the hydrographic mapping has been left to outsiders with commercial and military needs for safety of navigation at sea. It is only in the last half century that a few of the littoral states have begun mapping of their offshore. Since 1970, academic and national cruise reports, GEBCO plotting sheets, passage soundings, data from local surveys, and US, UK, and Russian national charts have been collected with an eye to making such a compilation. But the breakthrough has been the advent of satellite navigation (primarily GPS and GLONASS) since 1985, establishment of the World Geospatial System 1984 (WGS84), repeat satellite altimetry, and ever more accurate land topography (ASTER30 and 30m data and follow-on) which tie together the myriad sources of sounding data. Legacy detailed bathymetry of small coastal islands can now be more properly georeferenced in a world where safe passage of deep draft shipping is the main concern of the charts.

Examples of Initial Submarine Derived Bathymetry (SDB) (left) Dakik Archipelago off the coast of Eritrea in the Red Sea, ASTER30m topography, and OMEGA30m SDB superimposed on a 100m grid derived from soundings and contours of Russian Chart 4015. Left: The NW end of the Persian Gulf where the Tigris and Euphrates rivers flow out of Iraq, with the Albaids in southern Iran to the right. The flat ASTER2 land topography is darkened by the vertical exaggeration of 5X. The bathymetric profiles are along the yellow tracks in this Global Mapper image.

Under no circumstances should this compilation be used for navigation.