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MARM11: MARINE GEOLOGICAL STUDY OF THE NORTH ANATOLIAN FAULT BENEATH THE SAROS GULF (N.AEGEAN)

R/V URANIA CRUISE REPORT (2011-09-23 – 2011-10-10)

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R/V URANIA CRUISE REPORT (2010-09-29 – 2010-10-18)

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Includes bibliographical reference and index.
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Abstract -

1. ABSTRACT

The Oceanographic cruise MARMARA2011 was organized to study seismogenic faults in the submerged part of the North Anatolian Fault system, that constitute the plate boundary between Anatolia and Eurasia. The original proposal for the expedition included working areas in the Sea of Marmara and NE Aegean. However, cuts in the ship time after cruise approval suggested to limit our work in the Gulf of Saros (NE Aegean). The name MARMARA2011, the more recent of a series of expedition on board of the CNR *R/V Urania*, since 2001, was maintained. The Gulf of Saros is a triangular-shaped basin that forms at the passage between the almost pure strike-slip deformation on the Eastern end of the Marmara Sea and the Ganos Fault, to the transtensive/extensional deformation that accommodates anticlockwise rotation of Anatolia and the opening of the Hellenic back-arc basin towards West. The objective was to resolve geometries and kinematics of North Anatolian Fault (NAF) system in a conservative environment such as the seafloor. Reliable estimates of seismic hazard in each of the NAF segments depend critically on the identification of the active faults and by associating these faults with specific historical earthquakes. The main objectives of our project were: (1) identify the main faults carrying the current plate motion through Marmara; (2) date their most recent ruptures at the same scale as typical paleoseismic studies on land; (3) verify the effect of historical and proto-historical large (M7+) earthquakes in the sedimentary sequence.

Sommario - Vengono presentati le metodologie e l'insieme dei risultati ottenuti durante la campagna MARM11di rilievi geofisici, geologici e oceanografici nel Golfo di Saros (N.Egeo). E' stata utilizzata la nave da ricerca *R/V Urania* del CNR. Sono stati raccolti dati di multibeam, Chirp SBP, Sparker, SSS

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ACRONYM	DESCRIPTION	URL-email
CNR	Consiglio Nazionale Delle Ricerche	www.cnr.it
ISMAR	Istituto di Scienze Marine	www.bo.ismar.cnr.it
ITU	Istanbul Technical University	www.itu.edu.tr
EMCOL	Eastern Mediterranean Center for Oceanography and Limnology	www.mines.itu.edu.tr/emcol/
COMU	Çanakkale Onsekiz Mart Universitesi	www.comu.edu.tr
DEU	Dokuz Eylul Universitesi	https://http://kisi.deu.edu.tr/
UNIBO	University of Bologna	https://www.unibo.it
UNIGE	University of Genova	www.unige.it
UNIVPM	Polytechnic University Marche	http://www.univpm.it
SO.PRO.MAR.	Societa' Promozione lavori Marittimi Fiumicino (Italy)	www.sopromar.it b
SEG	Soc. of Exploration Geophysicists	www.seg.org
XTF	Extended Triton Format	www.tritonelics.com
JSTAR		
GPS-DGPS-RTK	Global Positioning System	samadhi.jpl.nasa.gov
DTM	Digital Terrain Model	en.wikipedia.org
SRTM	Shuttle Radar Topogr.Mission	www2.jpl.nasa.gov/srtm
MBES	MULTIBEAM ECHOSOUNDER SYSTEM	
SBP	Sub Bottom Profiling	
SSS	Side Scan Sonar	
PSU	Practical Salinity Scale	ioc.unesco.org
UTM	Universal Transverse Mercator	
UTC	Universal Time Coordinated	
WGS84	World Geodetic System 1984	
NMEA	National Marine Electronics Association	www.nmea.org
SBE	Sea Bird Electronics	www.seabird.com
BENTHOS	Teledyne Benthos	www.benthos.com
SIS	Sea Floor Inf. System	www.kongsberg.com
KONGSBERG	Kongsberg Maritime	www.kongsberg.com
MARINE MAGNETICS		
COMM-TECH	Communication Technology	www.comm-tec.com
GEO-RESOURCES	www.geo-resources.com	
EDGETECH	www.edgetech.com	
MB-SYSTEM	MB-SYSTEM	www.ldgo.columbia.edu/MB-System
GMT	Generic Mapping Tool	gmt.soest.hawaii.edu/gmt

Table 1: Acronyms of Organizations, Manufacturers and Products

ACKNOWLEDGMENTS

Many people contributed to the success of the research cruise (MARM11 *R/V Urania*). We are particularly indebted to the Captain Vincenzo Lubrano Lavadera, the officers and crew members of *R/V Urania* for their professionalism and efforts in assuring the success of the cruise. The project was funded by Italian CNR.

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2. INTRODUCTION AND BACKGROUNDS

The Sea of Marmara forms an active pull-apart basin developed along the North Anatolian Fault system, that extends east-west for over 1600 km across Turkey and is one of the world's major continental transforms. Earthquake epicenters and focal mechanism solutions in western Anatolia show a clustering on or near the major faults. A sequence of eight M7+ earthquakes has ruptured this boundary progressively from east to west during the last century. The most recent and westernmost events in this sequence, the M7.4 Izmit and M7.1 Duzce mainshocks in 1999, were particularly destructive. Together they ruptured about 160 km of this fault system including the submarine portion of the fault in the Gulf of Izmit, eastern Marmara Sea. Relatively little strain, however, is thought to have been released by earthquakes along 150 km of the transform through the Marmara Sea since the mid 1700's. This portion of the transform is, therefore, identified as a seismic gap where accumulated elastic strain is about as much as it was released by slip in the 1999 sequence. The western end of the Marmara gap is constituted by the Ganos Fault, that ruptured in 1912. The study of this segment of the NAF system is the objective of MARM11 expedition.

2.1. METHODOLOGY

After the 1999 disastrous earthquakes the international community is facing the attempt to produce maps of the faults distribution in the Marmara region. This project is attempting to study the seismogenic behaviour of the fault system. We believe that an integrated approach involving the acquisition and analysis of geophysical (multibeam, side-scan sonar, chirp), geological (cores) and seismological data would represent an innovative strategy in the emerging field of submarine earthquake geology to assess the seismic hazard in the Marmara region. The project involves a geological/geophysical survey that will combine multibeam, side- scan sonar maps and chirp sub-bottom profiles with carefully positioned core samples to resolve the shallow geometry and kinematics of portions of the fault system in the north eastern Marmara Sea. We expect to resolve fault geometry and kinematics and to date their most recent ruptures at the same scale as typical paleoseismic studies on land. We are guided by previous and ongoing projects studying larger scale and deeper characteristics of the fault array in the Marmara. Our strategy has been to juxtapose morphology and structures along this known rupture with other faults that may have ruptured in previous historic earthquakes near the Ganos Fault, such as the very large and destructive event of 1912. In the analysis of data, particularly important will be to identify features characteristic of submarine ruptures of transcurrent faults which may be subtle in reflection profiles. The entire cruise has been devoted to the study of the Gulf of Saros, in the North Eastern Aegen Sea, along the continuation of NAF track.

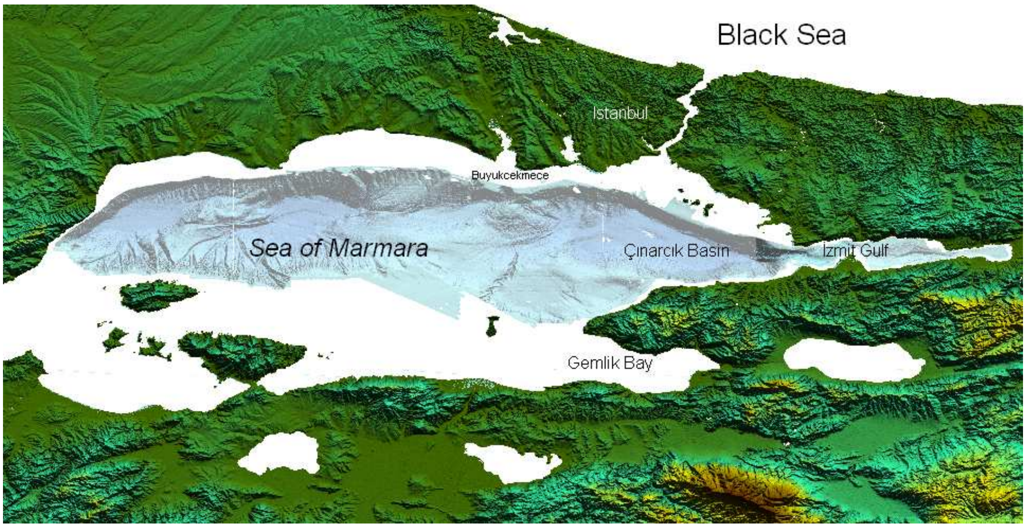

Figure 1: Sea of Marmara region setting. Bathymetry from Ifremer Atlas (Le Pichon and et al., 2005), DTM from SRTM data (Shuttle Radar Topogr. Mission NASA/ASI)

Specific tasks carried out during MARM11 cruise were :

1 collect multibeam data from the Saros shelves in depths ranging from 50 to 800 m together with high-resolution 2D seismic lines

2 collect cores at several sites in the Gulf of Saroa

Relevant previous or future research cruises

The present project is based on many previous research cruises carried out using R/V Odin Finder and R/V Urania and also on cruises of R/V Le Soroit and R/V L'Atalante within the framework of an Italy,France,USA and Turkey collaborative programme. The key areas have been identified through the interpretation of the previously collected geophysical and geological data along the NAF strands and cruise work was designed in order to map active structures and features likely useful to understand fault kinematics. For details about some of these cruises see:

- Odin Finder 2000, projects.bo.cnr.it/CRUISE_REPORTS/2005/MARM05_REP
- Urania 2001, projects.bo.cnr.it/CRUISE_REPORTS/2001/MARM2001_REP
- Urania 2005, projects.bo.cnr.it/CRUISE_REPORTS/2005/MARM05_REP
- Urania 2009, projects.bo.cnr.it/CRUISE_REPORTS/2009/MARM09_REP
- Yunus 2010, projects.bo.cnr.it/CRUISE_REPORTS/2010/MARM10_01_REP
- Urania 2010, projects.bo.cnr.it/CRUISE_REPORTS/2010/MARM10_02_REP

The references in bibliography cover broad aspects of the scientific problems and issues relating to the NAF in the Sea of Marmara, among the many others, tectonics, seismology, geochemical and sedimentary processes (Şengör, 1979; Barka, 1992; Çağatay et al., 1998; Hubert-Ferrari et al., 2002; Şengör et al., 2004, 1985; Armijo et al., 1999; McClusky et al., 2002; Armijo et al., 2002; Le Pichon et al., 2001, 2003; Aksu et al., 2000; Imren et al., 2001; Gokasan et al., 2001; Kuşcu et al., 2009; Alpar and Yaltirak, 2002; Demirbag et al., 2003; Barka and Kadinsky-Cade, 1988; Barka, 1992; Stein et al., 1997; Okay et al., 2000; Parke et al., 2002; Flerit et al., 2003; Polonia et al., 2004; Meade et al., 2002; Ambraseys and Finkel, 1991; Provost et al., 2003; Shindler, 1997; Okay et al., 2004; Polonia et al., 2002).

Moreover, in recent years a lot of effort was also devoted to the study of cold seeps, gas and fluid emissions. Geli et al. (2008) presents the results of geophysical investigations and of submersible dives during cruises MARMARA (R/V Le Suroit, September 2000) and MARNAUT (R/V L'Atalante, May-June 2007), pointing to clearcut evidence of gas and fluid emissions and active tectonics in the Dea of Marmara, particularly in the ÇinarcikBasin. Çağatay et al. (2009) discusses the late Pleistocene-Holocene stratigraphy of the northern shelf of the Sea of Marmara extending back to isotope stage 6. This study reports the discovery of two new sapropel units deposited during isotope stage 5 highstand and discusses water exchange between the Black Sea and Mediterranean through the Sea of Marmara during various isotopic stages, based on seismic stratigraphic and core analyses.

Two recent publications (Gasperini et al., 2011a,b) discuss the problem of the geological slip rates in thye Marmara region.

3. CRUISE SUMMARY

SHIP: *R/V Urania* Flag: Italy [IT] Call Sign: IQSU IMO: 9013220, MMSI: 247498000
START: 2011-09-23 PORT: Messina
END: 2011-10-10 PORT: Napoli
SEA/OCEAN: Aegean Sea, Mediterranean Sea
LIMITS: NORTH 40:50.0 SOUTH: 36:50.0 WEST: 15:30.0 EAST: 27:00
OBJECTIVE: Active Faults and historical earthquakes in the Marmara Region
COORDINATING BODIES: ISMAR-Bologna BOLOGNA (ITALY)
CHIEF OF EXPEDITION: Luca Gasperini (ISMAR-CNR)
CONTACT: Luca.Gasperini@ismar.cnr.it
DISCIPLINES: MARINE GEOLOGY, MARINE GEOPHYSICS, PHYSICAL OCEANOGRAPHY
WORK DONE: MULTIBEAM, CHIRP SBP, SPARKER, SSS
20 LONG GRAVITY CORES, 24 SHORT INTERFACE CORES, 4 GRABS, 17 CTD CASTS

LOCALIZATION:

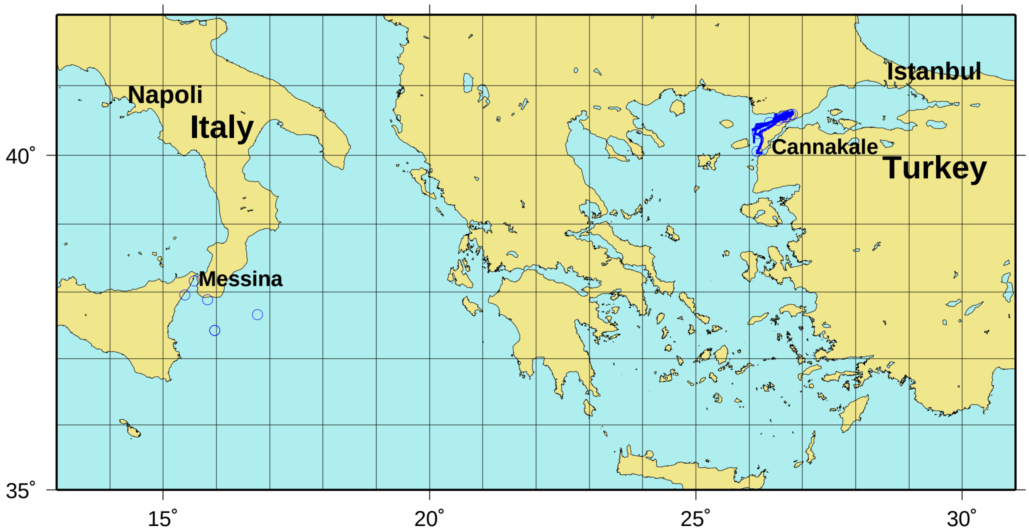

Figure 2: General ship tracks during Cruise MARM11, including transits from and to Napoli.

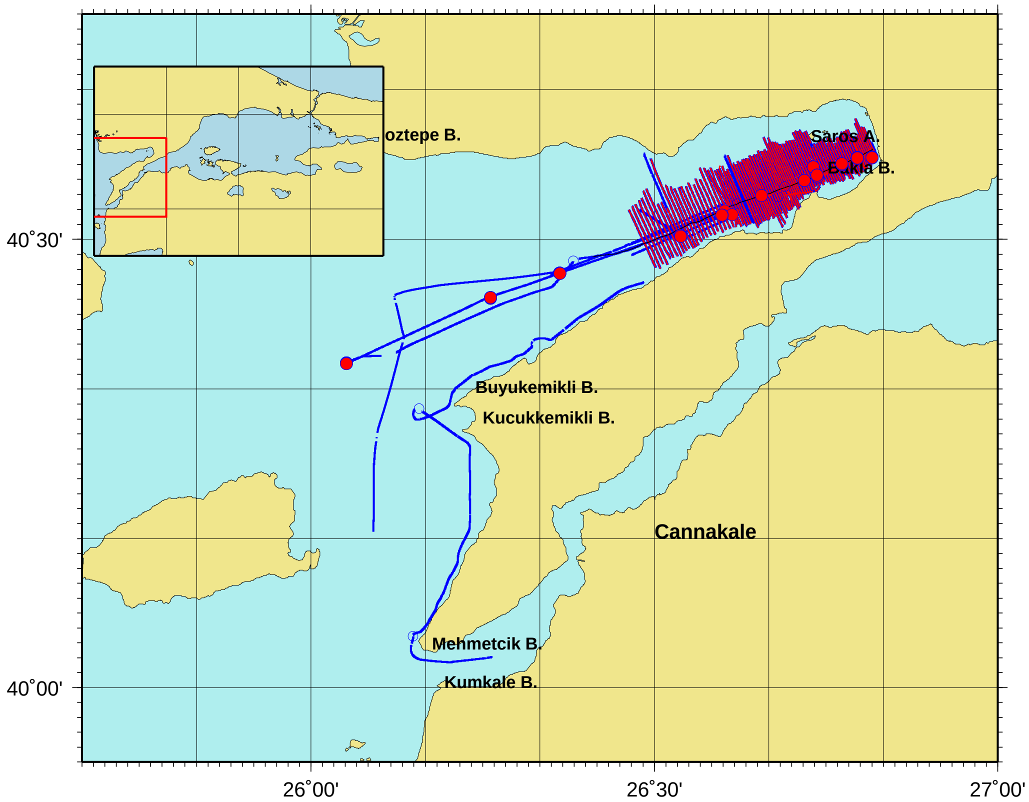

Figure 3: Ship tracks during cruise MARM11, Saros Gulf Area. Red and blue circles and squares are coring locations. Red hollow circles are CTD and water sampling locations.

Table 2: CTD Stations. Cruise MARM11 with *R/V Urania*.

LON LAT	STAZ.	DATA-NMEA	DATA-UPLOAD	FILE
ddmm.xxx		UTC		FILE
1558.080 3725.560	003	2011-02-24T13:01:11	2011-00-24T12:59:52	M2011-ctd03.hex
1558.130 3725.420	004	2011-02-24T13:47:20	2011-00-24T13:45:49	M2011-ctd04.hex
1646.350 3739.770	05	2011-02-25T08:17:32	2011-00-25T08:17:09	M2011-ctd05.hex
2608.900 4003.440	06	2011-02-28T09:06:13	2011-00-28T09:04:26	M2011-ctd06.hex
2609.450 4018.700	07	2011-02-28T11:54:59	2011-00-28T11:54:02	M2011-ctd07.hex
2637.210 4032.380	08	2011-01-29T14:27:43	2011-00-29T14:26:32	M2011-ctd08.hex
2640.810 4032.840	CTD	09	2011-02-01T10:43:07	2011-00-01T10:41:29
2646.490 4034.910	CTD	10	2011-02-01T13:55:26	2011-00-01T13:53:33
2648.960 4035.570	CTD	11	2011-02-02T10:51:02	2011-00-02T10:49:55
2632.500 4030.260	12	2011-02-03T05:32:30	2011-00-03T05:31:16	M2011-ctd12.hex
2622.910 4028.560	13	2011-02-03T19:51:05	2011-00-03T19:49:42	M2011-ctd13.hex
2641.390 4033.520	14	2011-02-04T05:22:19	2011-00-04T05:21:11	M2011-ctd14.hex
1549.830 3752.870	CTD	15	2011-02-07T19:46:32	2011-00-07T19:44:34
1524.350 3757.090	CTD	16	2011-02-08T07:48:46	2011-00-08T07:46:49
1534.860 3809.730	CTD	17	2011-02-08T15:47:53	2011-00-08T15:46:19

Table 3: Bottom sample positions. Latitude, Longitude true position, Time UTC

LON LAT	EAST NORTH	CORE	PEN REC PULL	DATE TIME
ddmm.xxx	UTM		m m kg	UTC
2649.017 4035.435	484509.2 4493403.5	SAG01	6.00 2.52 3315	2011-10-02 11:16:10
2649.011 4035.471	484501.6 4493392.6	SAI01	- - -	2011-10-02 11:46:29
2649.006 4035.476	484495.1 4493401.0	SAI01	- - -	2011-10-02 12:05:25
2649.007 4035.479	484496.8 4493407.9	SAI02	- - -	2011-10-02 12:25:09
2649.009 4035.442	484499.1 4493415.9	SAG02	5.80 2.52 3098	2011-10-02 12:38:08
2647.742 4035.410	482711.0 4493360.4	SAG03	6.30 2.57 3445	2011-10-02 14:07:22
2647.739 4035.453	482708.4 4493362.1	SAI03	- - -	2011-10-02 14:24:46
2647.738 4035.454	482706.2 4493364.6	SAI04	- - -	2011-10-02 14:33:45
2647.737 4035.415	482703.9 4493370.3	SAG04	6.30 2.26 3423	2011-10-02 14:52:30
2646.396 4035.032	480811.6 4492587.8	SAI05	- - -	2011-10-02 15:23:25
2646.396 4035.030	480811.7 4492585.2	SAI06	- - -	2011-10-02 15:32:25
2646.395 4034.993	480809.6 4492594.4	SAG05	6.30 2.18 3445	2011-10-02 15:56:52
2646.395 4035.036	480811.1 4492596.7	SAG06	6.10 2.20 2750	2011-10-02 16:48:36
2632.292 4030.208	460870.3 4483820.0	SAG07	5.85 2.19 3488	2011-10-03 06:13:18
2632.295 4030.244	460876.6 4483808.6	SAI07	- - -	2011-10-03 06:45:37
2632.287 4030.263	460866.0 4483842.9	SAI07	- - -	2011-10-03 07:11:09
2632.269 4030.258	460839.6 4483834.8	SAI08	- - -	2011-10-03 07:26:53
2632.306 4030.202	460890.4 4483808.9	SAG08	4.10 1.80 2253	2011-10-03 07:45:27
2621.719 4027.764	445908.6 4479314.4	SAI09	- - -	2011-10-03 09:27:23
2621.733 4027.754	445927.9 4479294.7	SAI10	- - -	2011-10-03 10:01:48
2621.731 4027.716	445922.6 4479302.4	SAG09	6.60 2.75 3878	2011-10-03 10:30:29
2621.731 4027.720	445922.1 4479308.6	SAG10	6.60 2.75 3986	2011-10-03 11:30:07
2615.682 4026.076	437348.7 4476334.9	SAG11	6.40 2.60 3813	2011-10-03 12:45:02
2615.675 4026.115	437342.7 4476329.7	SAI11	- - -	2011-10-03 13:15:36
2615.679 4026.114	437348.4 4476327.4	SAI12	- - -	2011-10-03 13:44:34
2615.678 4026.115	437347.4 4476328.6	SAG12	7.90 5.90 3813	2011-10-03 14:17:57
2603.104 4021.699	419480.8 4468406.7	SAG13	7.10 3.34 3445	2011-10-03 16:14:14
2603.102 4021.745	419482.8 4468414.0	SAI13	- - -	2011-10-03 16:43:40
2603.105 4021.743	419486.2 4468410.9	SAI14	- - -	2011-10-03 17:10:18
2603.111 4021.702	419491.0 4468411.2	SAG14	7.10 3.28 3618	2011-10-03 17:36:31
2644.240 4034.179	477766.6 4491019.2	SAG15	5.30 1.90 3618	2011-10-04 06:02:45
2644.246 4034.173	477774.3 4491007.4	SAI15	- - -	2011-10-04 06:16:26
2644.245 4034.172	477772.9 4491005.9	SAI16	- - -	2011-10-04 06:24:28
2644.244 4034.168	477772.2 4490997.8	SAG16	5.25 1.85 3293	2011-10-04 06:41:51
2643.885 4034.814	477268.6 4492195.6	SAI17	- - -	2011-10-04 07:06:23
2643.880 4034.813	477261.8 4492193.0	SAI18	- - -	2011-10-04 07:17:50
2644.207 4034.284	477720.0 4491214.0	SAG19	5.55 2.22 3553	2011-10-04 07:35:42
2644.210 4034.281	477724.7 4491207.5	SAI19	- - -	2011-10-04 07:45:35
2644.207 4034.283	477720.4 4491210.8	SAI20	- - -	2011-10-04 07:52:14
2644.205 4034.284	477718.1 4491212.8	SAG20	5.60 2.26 3661	2011-10-04 08:15:00
2643.089 4033.925	476140.8 4490553.4	SAG21	5.60 2.45 3531	2011-10-04 12:58:05
2643.094 4033.926	476147.7 4490556.3	SAI21	- - -	2011-10-04 13:10:06

Table 3: Bottom sample positions. Latitude, Longitude true position, Time UTC

LON LAT	EAST NORTH	CORE	PEN REC PULL	DATE TIME
ddmm.xxx	UTM		m m kg	UTC
2643.094 4033.926	476147.7 4490556.3	SAI22	- - -	2011-10-04 13:20:06
2643.091 4033.924	476143.3 4490552.8	SAG22	5.55 2.38 3488	2011-10-04 13:34:32
2639.360 4032.932	470872.7 4488735.4	SAI23	- - -	2011-10-04 14:32:00
2639.359 4032.924	470871.3 4488720.2	SAI24	- - -	2011-10-04 14:41:33
2636.137 4031.896	466316.3 4486838.7	SAGR01		2011-10-04 15:45:27
2636.786 4031.649	467230.5 4486378.0	SAGR02		2011-10-04 16:19:42
2635.929 4031.617	466020.4 4486323.2	SAGR03		2011-10-04 16:48:04
2635.906 4031.626	465986.9 4486339.8	SAGR04		2011-10-04 17:10:19
1539.867 3757.525	558369.9 4201446.9	IONCA05	n.d. 1.91 2448	2011-10-07 22:04:43
1524.365 3757.113	535675.9 4200554.8	IONCA06	3.05 1.81 1993	2011-10-08 07:33:33
1547.030 3730.500	1386332.3 3538074.7	IONCA01	n.d. core-catcher	2011-09-24 09:16:24
1557.705 3725.565	1401959.9 3529010.7	IONCA02	n.d. pipe	2011-09-24 12:08:08
1617.269 3727.432	1430598.5 3532438.6	IONCA04	7.30 5.43 4571	2011-09-24 16:33:23

SCIENTIFIC AND TECHNICAL PARTIES

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Table 4: Scientific and technical parties

4. MATERIALS AND METHODS

The research cruise was carried out with the 61 meter *R/V Urania* (Fig.4), owned and operated by SO.PRO.MAR. and on long-term lease to CNR. The ship is normally used for geological, geophysical and oceanographical work in the Mediterranean Sea and adjoining waters, including but not limited to, the Atlantic Ocean, the Red Sea, and the Black Sea.

R/V Urania is equipped with DGPS and SEAPATH positioning system (satellite link by FUGRO), single-beam and multibeam bathymetry and integrated geophysical and oceanographical data acquisition systems, including ADCP, CHIRP SBP and other Sonar Equipment, other than water and sediment sampling. Additional equipment can be accommodated on the keel or towed.

Figure 4: *R/V Urania*.

4.1. NAVIGATION AND DATA ACQUISITION

The vessel was set-up for data acquisition and navigation with PDS-2000 software by RESON, interfacing by a multiserial and Ethernet link several instruments, among them the DGPS (Fugro), the Atlas-Krupp Deso-25 single-beam echosunder, the MAHRS MRU and the meteorological station. The position and depth data were also distributed to the CTD data acquisition console. A Kongsberg processor running the SIS software, collected the multibeam data, including a SEAPATH MRU, compass, and DGPS. The MBES was the 70kHz, 400 1x2°, 150°aperture EM-710 (2000 m range) model by Kongsberg, with sonar head positioned on the ship's keel using a steel frame. A Sound Velocity probe at the keel 1m above the Sonar Head is interfaced directly to the MBES processor, thus providing the necessary real-time data for the beam-forming. CTD casts were used for input of the sound velocity profile to the system. A Meteofrance's NATOS Meteorological Station was also made available, at a rate of one measurement every 5 minutes.

POSITION	ACROSS	ALONG	HEIGHT
REFERENCE POINT	0.00	0.00	0.00
DGPS	1.64	14.30	14.18
MBEAM	0.00	14.36	-4.96
MAHRS	0.00	0.0	-3.40
ECHO SOUNDER 33	5.50	-1.85	-3.80
CHIRP	-1.0	11.80	-4.00
A-FRAME	6.5	-6.70	0.0
STERN	0.00	-30.60	0.00
SSS-TP	-3.0	-30.60	0.00
MAG	-3.0	-130.60	0.0

Table 5: Instrumental Offsets of PDS2000 on Ship Urania (PDS2000). The GPS antenna (primary positioning system) is located on point DGPS.

POSITION	ACROSS	ALONG	HEIGHT
REFERENCE POINT	0.00	0.00	0.00
SEAPATH_GPS	-4.039	0.163	-18.211
MRU	-0.341	-1.342	-1.596
MBEAM_TX	0.0936	10.2964	5.0623
MBEAM_RX	-0.0031	11.0144	5.0600
SEALEVEL	0	0	-0.0875

Table 6: Instrumental Offsets on Ship Urania (EM710). The DGPS antenna (primary positioning system) is located on point SEAPATH_GPS.

CTD DATA

CTD casts were taken throughout the surveyed areas, for sound velocity analysis, and were used for real-time MBES acquisition and post-processing. Data have been processed by the SBE Software, and bin-averaged ascii files were produced.

The position of the CTD stations are reported in Table 2 and can be viewed in Fig.3, respectively.

CHIRP SBP, SPARKER, SIDE SCAN SONAR, MAGNETOMETRY

SBP data was acquired by the 16 transducers, hull mounted BENTHOS (DATASONICS) Mod.CAP-6600 CHIRP-II profiler, with operating frequencies ranging between 2 and 7 kHz. The pulse length was mantained at 20 ms while the trigger rates varied from 0.25 to 1 seconds according to water depth. Digital data acquired by the Communication Technology SWANPRO software were recorded in the XTF format on local disks and transferred on the network upon request. Backups were loaded on HD and DVD. The navigation data was made available to the system as lat/long by NMEA sentences of the DGPS receiver at a rate of aproximately 1 Hz or by the PDS200's NMEA at 1Hz. The XTF data were then converted to SEG-Y by the Triton-Elics's Xtf2Seg software. This latter data were then input to the ISMAR's SEISPRO software (Gasperini and Stanghellini, 2009) for data processing and display.

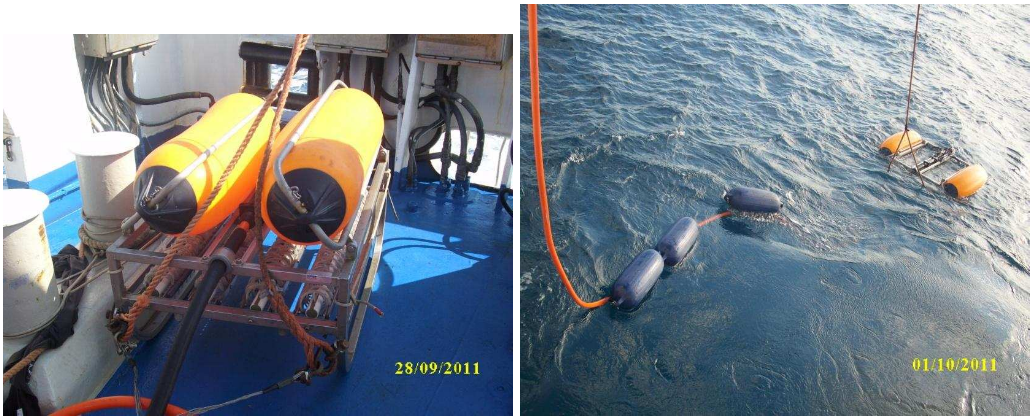

Figure 5: Geo-Resources GEO-SOURCE 1600 Sparker Source.

A 1.5 KJ Multi Tip sparker GEO-SOURCES by Geo-reosurces was towed astern on the starboard side (Fig.5). The power was generally set to 1.3 KJ. A 10 m long streamer was deployed on the port side by a 3m divergent and weights were set for towing at less than 0.5m water depth. The streamer data passed trough a fixed gain preamplifier and were digitized by a SB-Logger by Triton Imaging (Fig.6), that produced data files in the SEGY format.

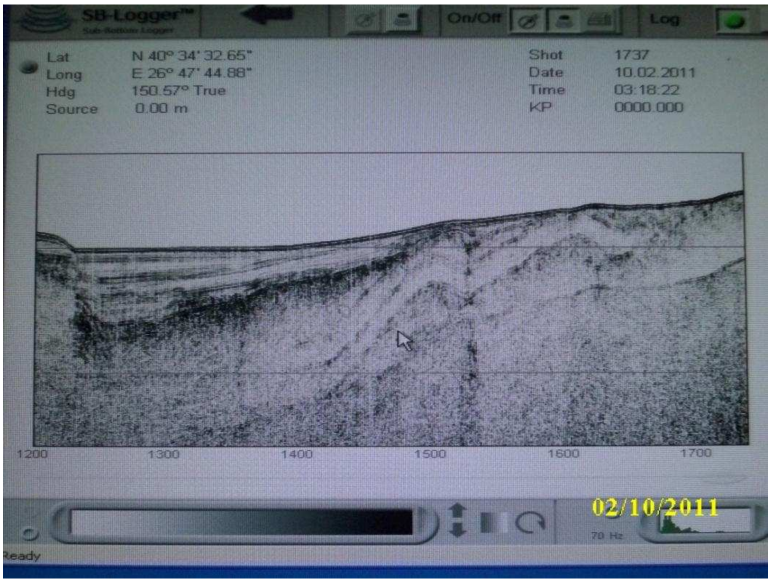

Figure 6: Geo-Resources Sparker Source, acquisition by Triton's SB-Logger.

An Edgetech 4200 FS (100 and 400 Khz) was used. The sonar data have been store in the Edgetch's Jstar (.jsf) and Triton-Imaging XTF formats.

A Marine Magnetics Seaspy magnetometer was used and deployed from the port side. The data were acquired by the Sealink software (Fig.0).

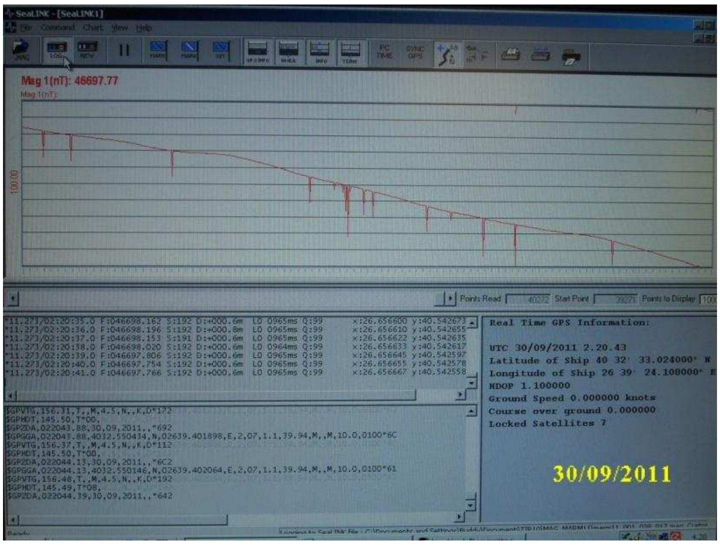

Figure 7: Sealink magnetometric data acquisition. The spikes are due to the sparker shots.

4.2. *SEABED SAMPLING*

The sea bottom samples were collected with 1.2 Ton gravity corer, with 6m pipes, diameter 12cm, generally with trigger release, (Fig.8) and with a Sediment/water corer using 1,2m m liners, disameter 7cm, Cores recovered by the 1.2T corer were split on 1m long pieces. All cores have been taken in two copies for turkish and italian teams.

The sample locations are shown in Fig.3 and are reported on Tab.3

Figure 8: Gravity corer.

4.3. *MISCELLANEOUS*

The WGS84 datum, the UTM35N projection and UTC were chosen for navigation and display, and for data acquisition. The time zone was set to the UTC for the instrumental data acquisition. The positioning maps and bathymetric images were produced with GMT (Wessel and Smith, 1995) and Globalmapper. The multibeam data were pre processed on board by the MB-SYSTEM, GMT software and ISMAR's routines and scripts, using the raw datafiles, after conversion to the ASCII format.

The computing center employed INTEL based PC running the GNU-Linux in addition to portable computer for data acquisition and personal processing. The Linux machines were used as data repositories using the SAMBA software, providing alse network services like WWW, DHCP and NAT.

5. DESCRIPTION OF DEPLOYMENTS AND OF DATA COLLECTED

Initial results are presented, in order to address the importance of the preliminary findings and processing sequence of the data acquired.

5.1. SEABED SAMPLING

Tables 3 and 7 show the positioning data and description of samples. Sampling by corers was successful even on hard grounds.

SAMPLE	DESCRIPTION
Grab_01	Grab is full (ca. 60 l) of muddy bioclastic sand (10Y 5/1) constituted mostly by molluscs fragments; no evident structure were recorded. No evident living fauna on the surface. The thanathocoenosis is dominated by molluscs *Timoclea ovata* (dominant), *Clausinella brogniartii* (very common), *Pitar rudis* (dominant), *Pteria hirundo*, *Mytilus* sp., *Cardita calyculata* and by the scleractinian *Caryophyllia* sp.
Grab_02	Grab is full (ca. 60 l) of muddy bioclastic sand (7.5GY 5/1) constituted mostly by molluscs fragments; no evident structure were recorded. 10 cm below the surface a thin layer (ca 5 cm) of gravels was present. No evident living fauna on the surface. The thanathocoenosis is dominated by molluscs *Cerastoderma glaucum* (common), *Turritella communis*, *Pitar rudis* (dominant), *Cardita calyculata*, *Mytilus* sp.
Grab_03	Only one cobble fouled by epifauna (serpulids).
Grab_04	ca. 30 l of muddy bioclastic sand (5GY 5/1) constituted mostly by molluscs fragments; no evident structure were recorded. No evident living fauna on the surface. The thanathocoenosis is characterized by molluscs *Mytilus* sp., *Timoclea ovata*, *Antalis dentalis*. Calcareous algae were also present.

Table 7: Cruise MARM11: grab description.

5.2. CHIRP, SBP, SIDE SCAN SONAR

A quick processing by SEISPRHO (Gasperini and Stanghellini, 2009) of CHIRP and SPARKER data was made on board for navigation and geological target selection, other that structural and stratigraphical analysys. Example of the recorded and processed data are shown in accompanying figures.

The data quality ranged from good to very good, with penetration down to 40 m (CHIRP) and ∼100m (SPARKER). The Side Scan Sonar data along the NAF trace revealed very interesting targets. On one of them (gas escape) a ROV dive was planned and executed.

5.3. CTD AND SOUND VELOCITY DATA

Figure 9 shows the SV profiles, the TS diagram and location of the CTD casts, in Marmara and the Dardanelles.

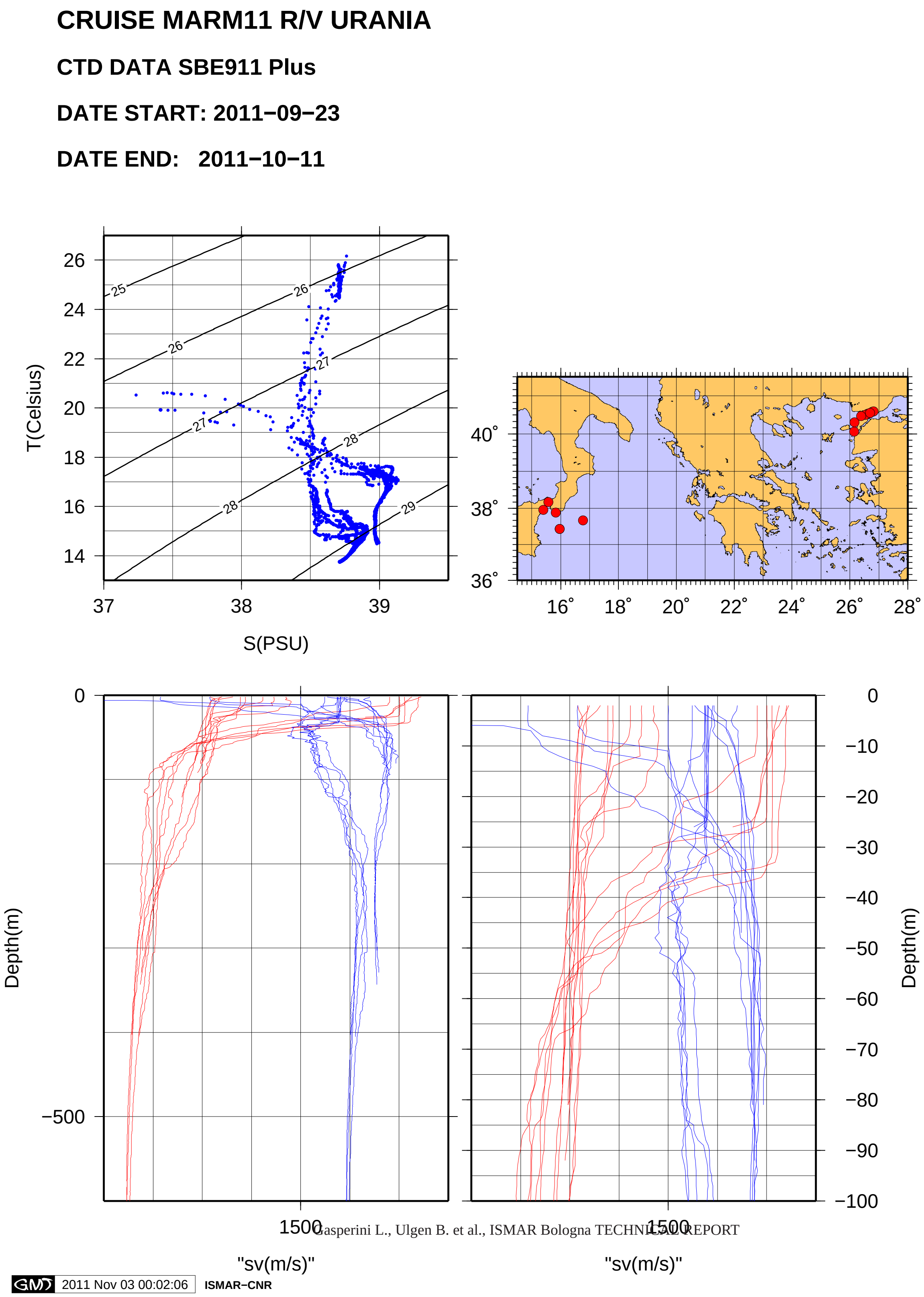

Figure 9: Cruise MARM11 CTD casts. Lower left: Sound Velocity(gray), T(red,13-28), S(blue, 37-39.25PSU). Upper left: TS diagram.

6. CONCLUDING REMARKS AND FUTURE WORKS

Main targets of MARM11cruise have been reached. A schematic list of first results is indicated.

- **Geophysical data**

  First results highlighted the high-resolution of the Multibeam, Chirp, Sparker and Side Scan Sonar systems on board of Urania that fitted perfectly the requirement of accuracy in mapping the subtle trace of active faults in the Gulf of Saros.

- **Sampling of the seabed** The seabed have been sampled by ISMAR gravity corers and turkish Water/sediment corers, that were also used for preserving the uppermost veneers of sediment and overlying waters.

- **ROV survey** we launched the ROV on the gulf of Saros just few m of the NAF, on areas potentially interesting for gas and fluid emissions.

Analysis of the data collected during the expedition is under process, and will continue during the forthcoming several months.

No problems were encountered regarding neither the people nor the environment during the cruise.

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7. APPENDIX

7.1. DIARY OF OPERATIONS

- 2011-09-23 Mobilization in Messina . Leave dock on 16:30 UTC, heading to Ionian Sea.
- 2011-09-24 Coring and Sparker Profiling in the Ionian Sea.
- 2011-09-25 17:00 UTC start transit to Canakkale.
- 2011-09-28 Arrive Cannakale at Dardanelles, at anchor 07:00 UTC. Custom and Police clearing, embark turkish colleagues. Leave anchor 09:00, head to CTD06 close to Cape Mehmetcik. Head to Saros Gulf.
- 2011-10-04 Anchored SW Istanbul. Embark Turkish and French Teams.
- 2011-10-05 Canakkale, disembark of Turkish participants. Sailing to Napoli, 09:00 UTC.
- 2011-10-08 Coring, multibeam Chirp South Messina Strait.
- 2011-10-10 Docking Naples 12:30 UTC.
- 2011-10-11 Disembark people, end of cruise 10:00 UTC.

7.2. POSITIONING MAPS OF MOST RELEVANT OPERATIONS AT SEA

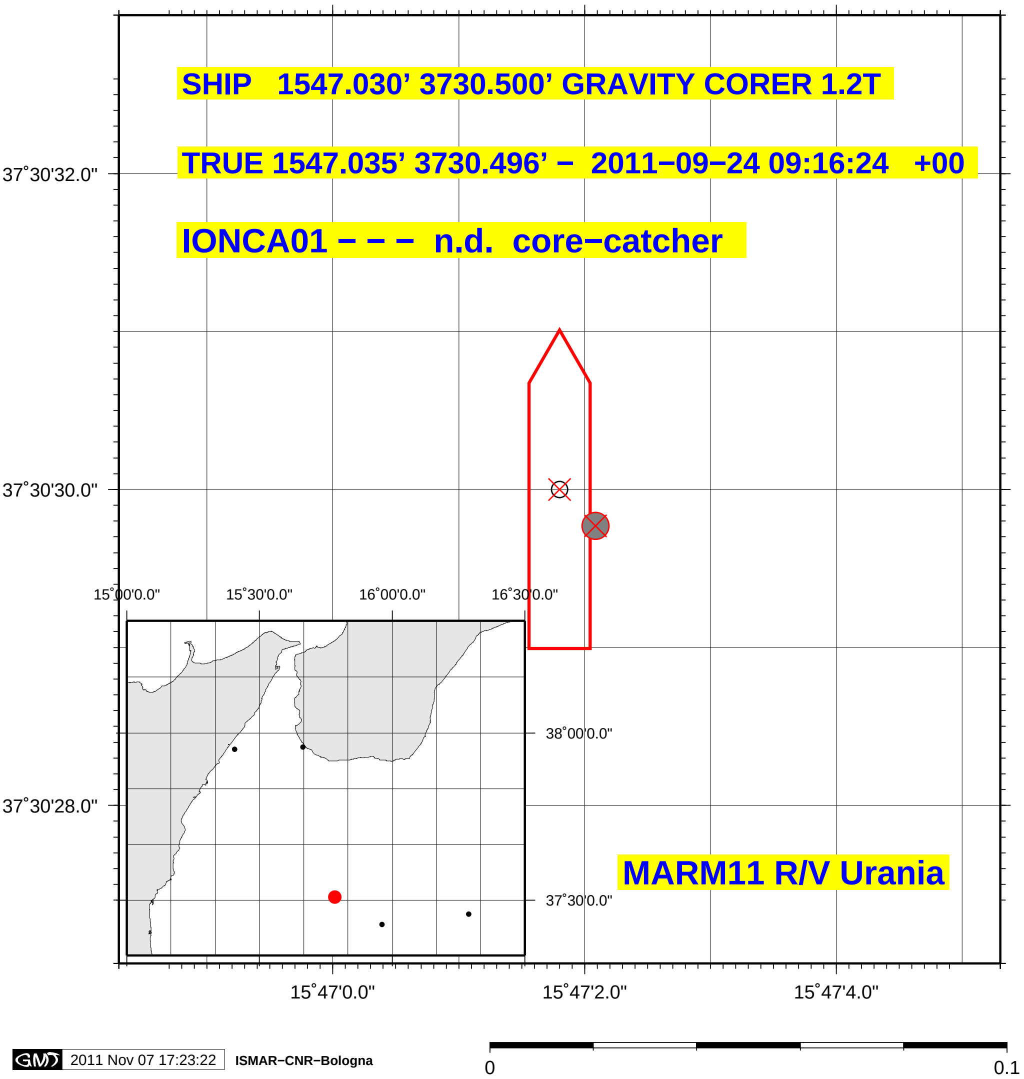

Figure 10: IONCA01 positioning data.

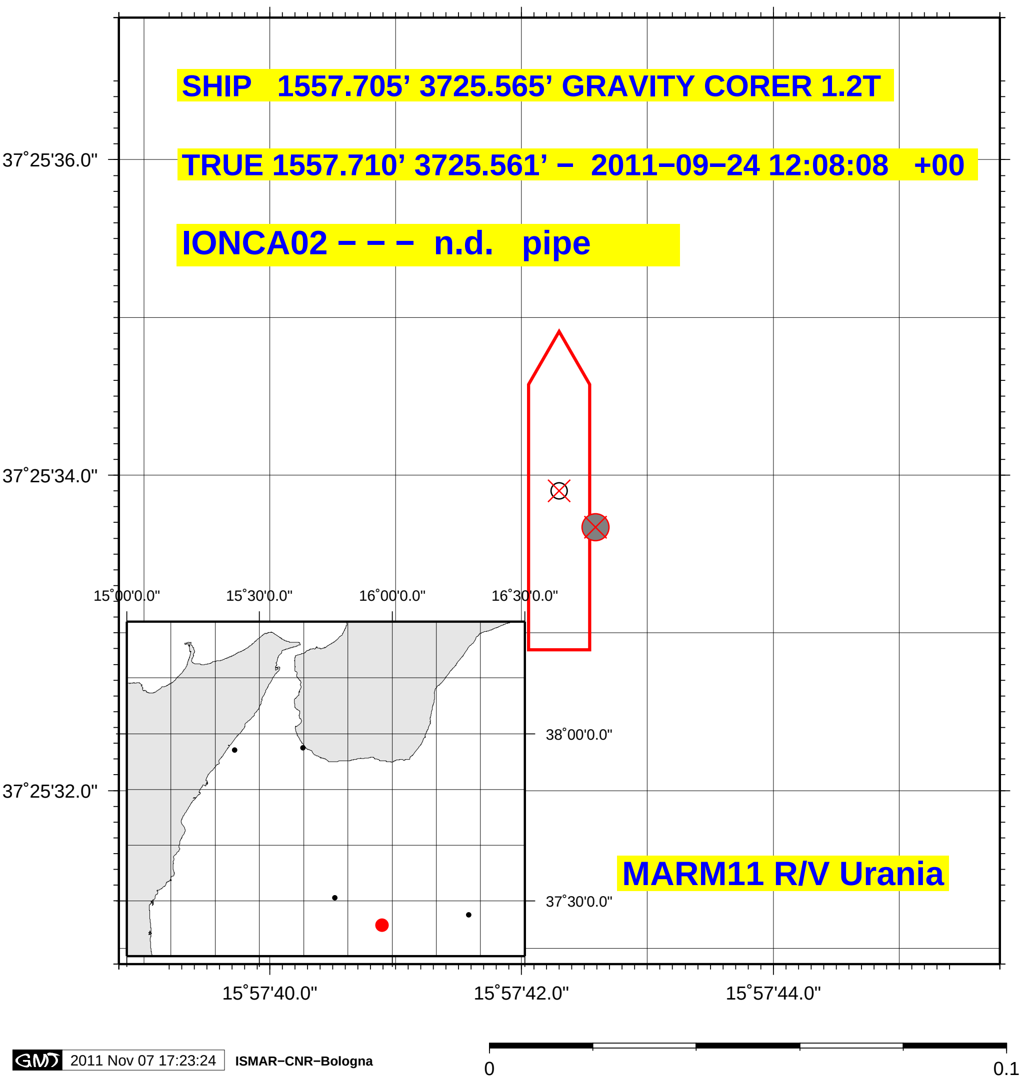

Figure 11: IONCA02 positioning data.

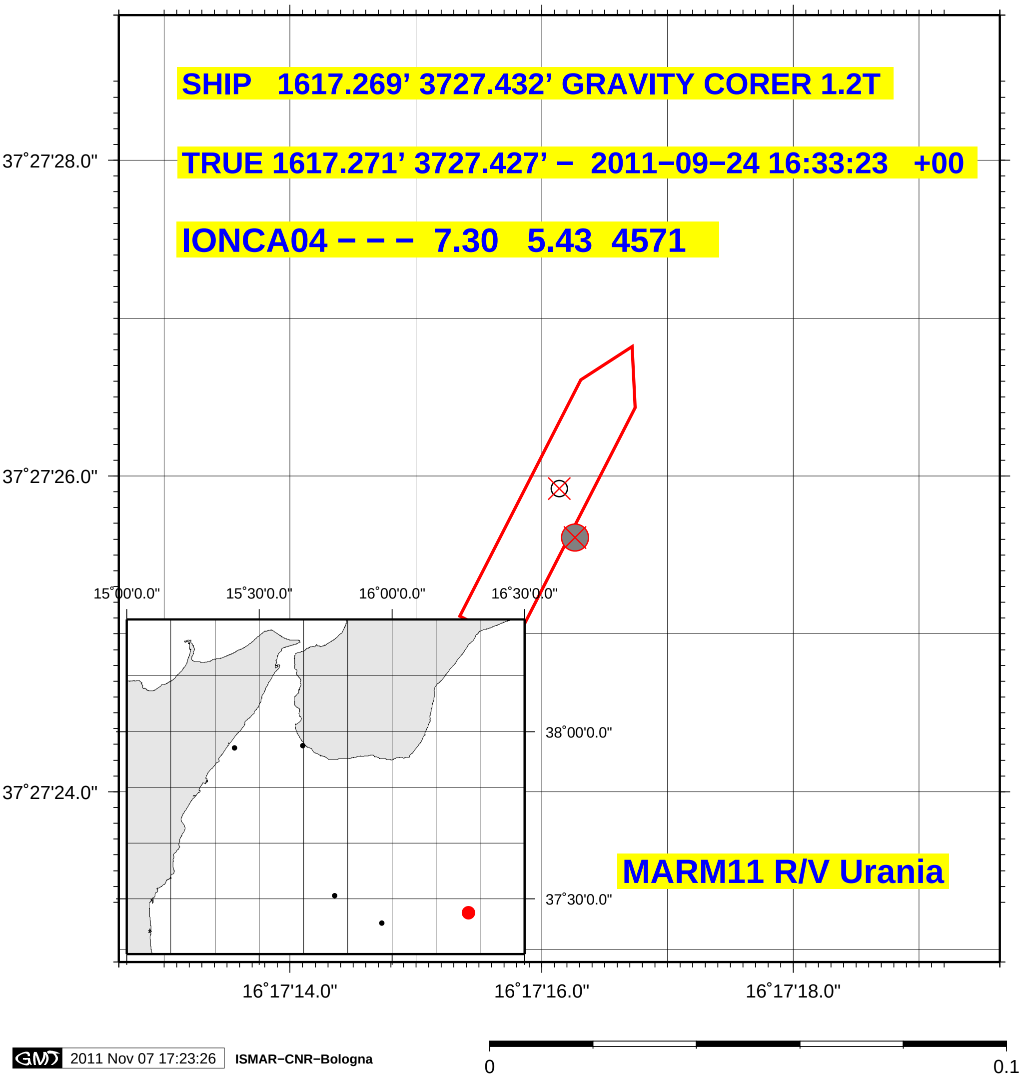

Figure 12: IONCA04 positioning data.

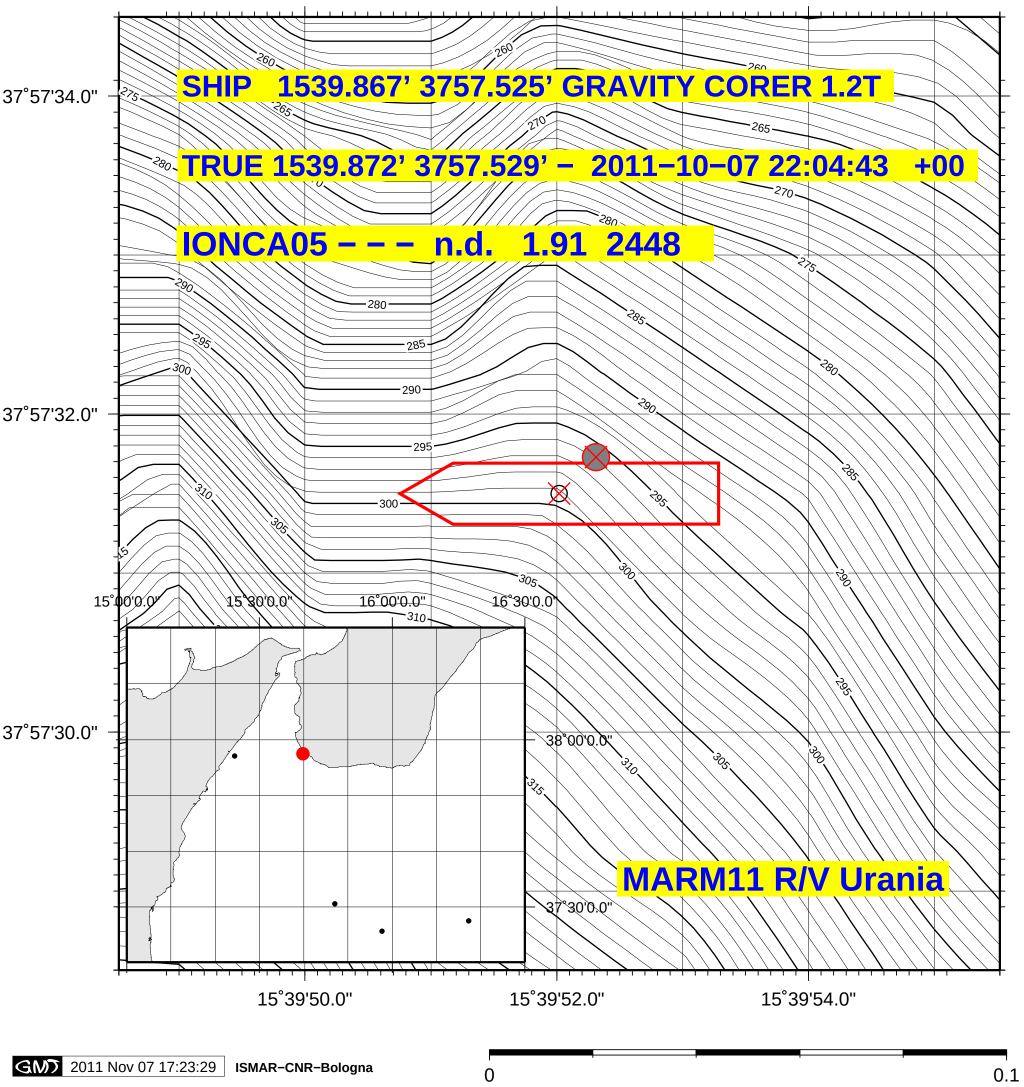

Figure 13: IONCA05 positioning data.

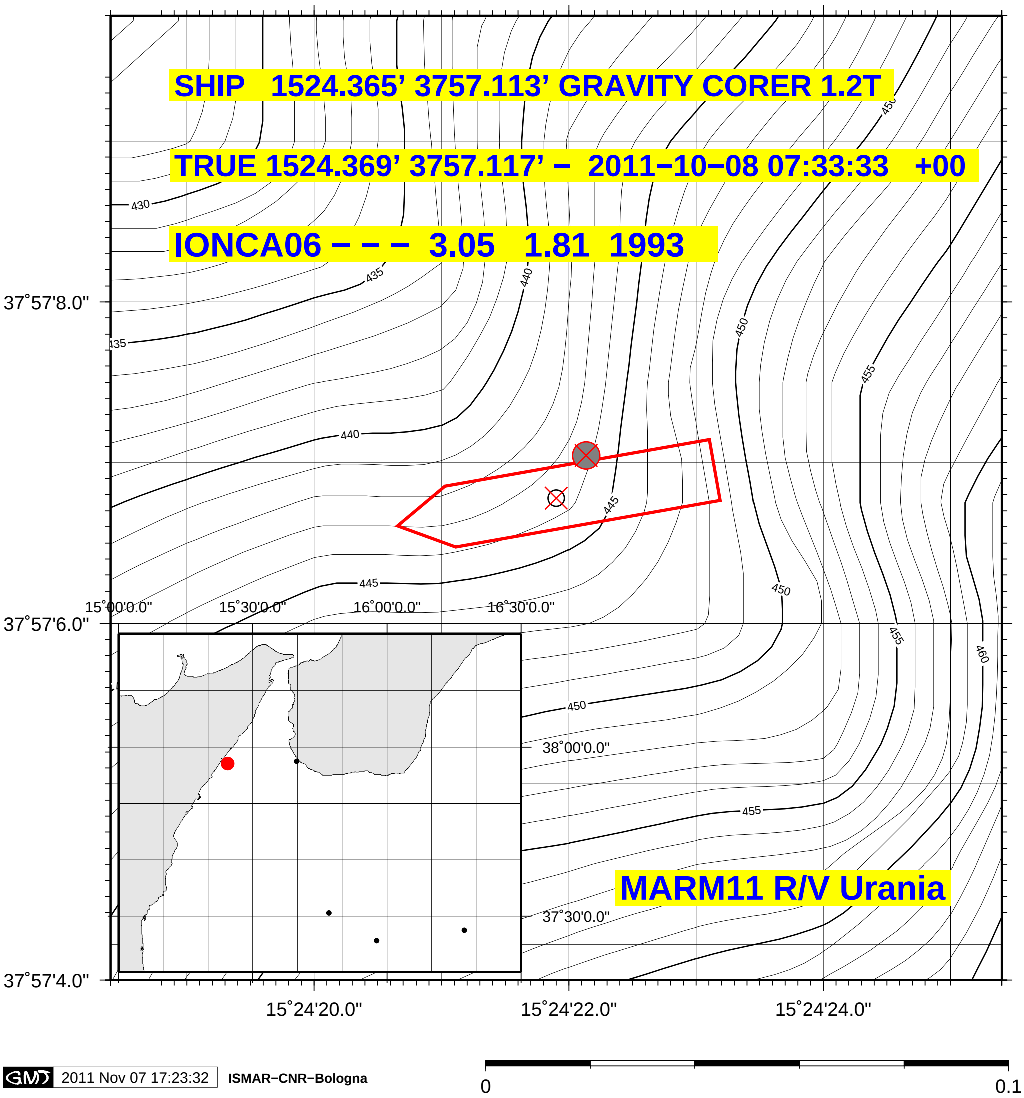

Figure 14: IONCA06 positioning data.

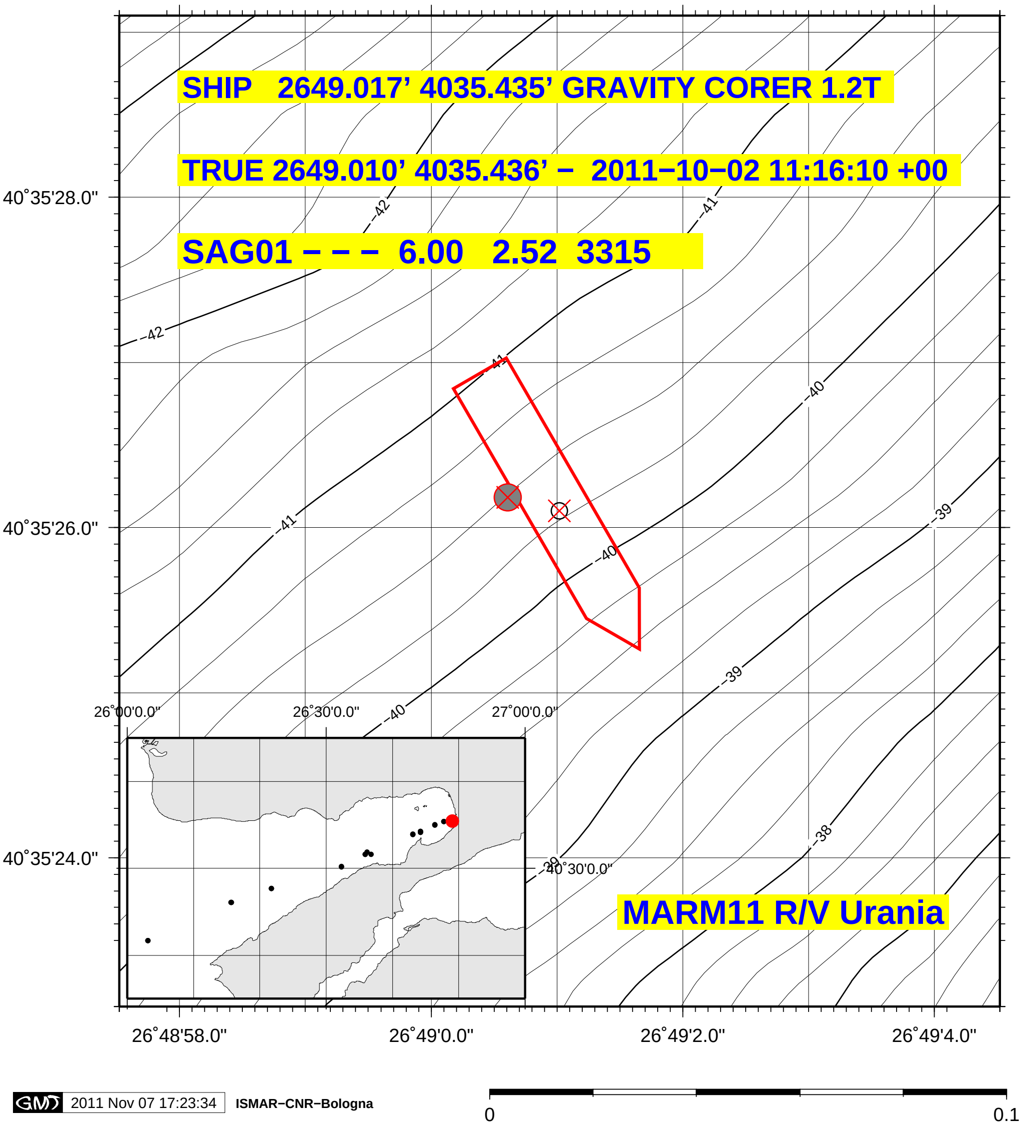

Figure 15: SAG01 positioning data.

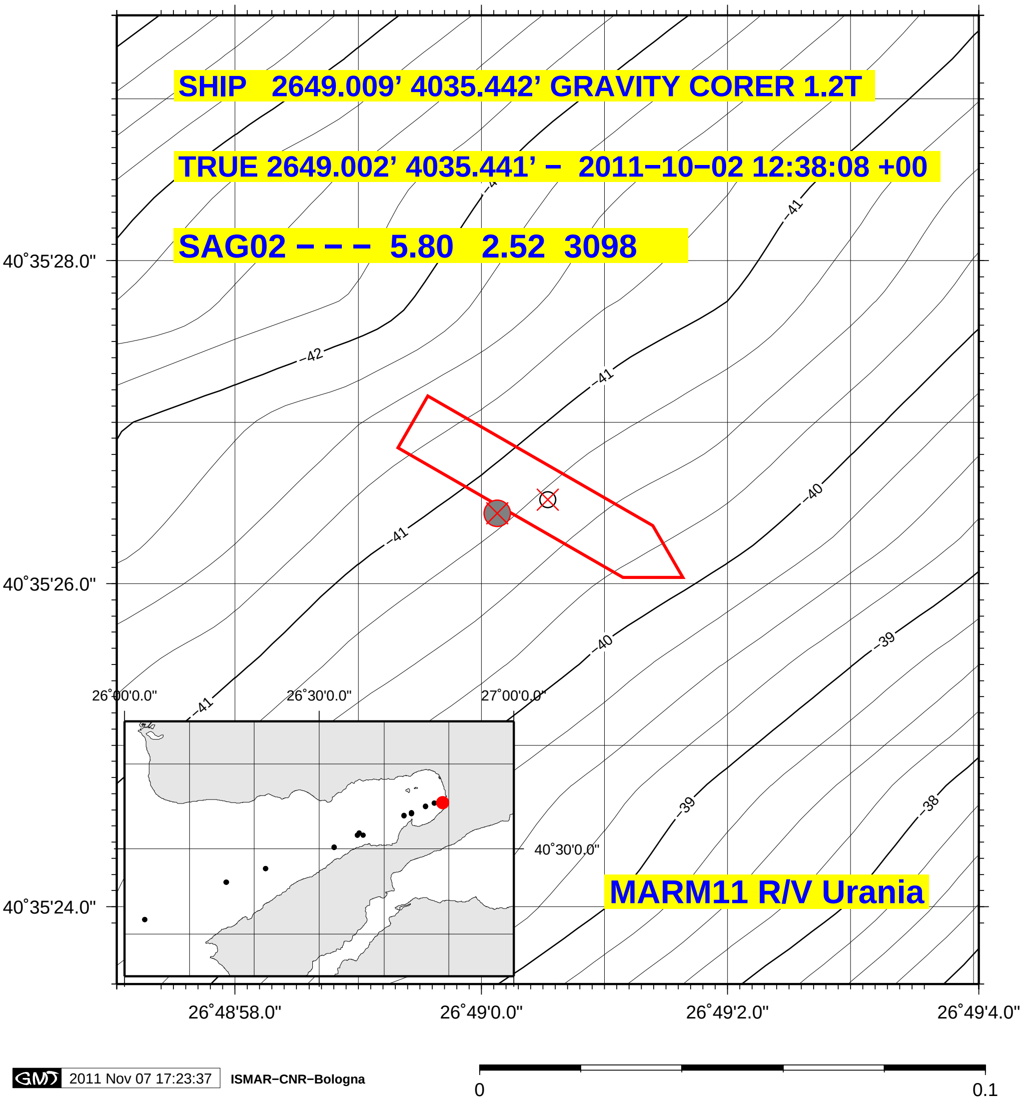

Figure 16: SAG02 positioning data.

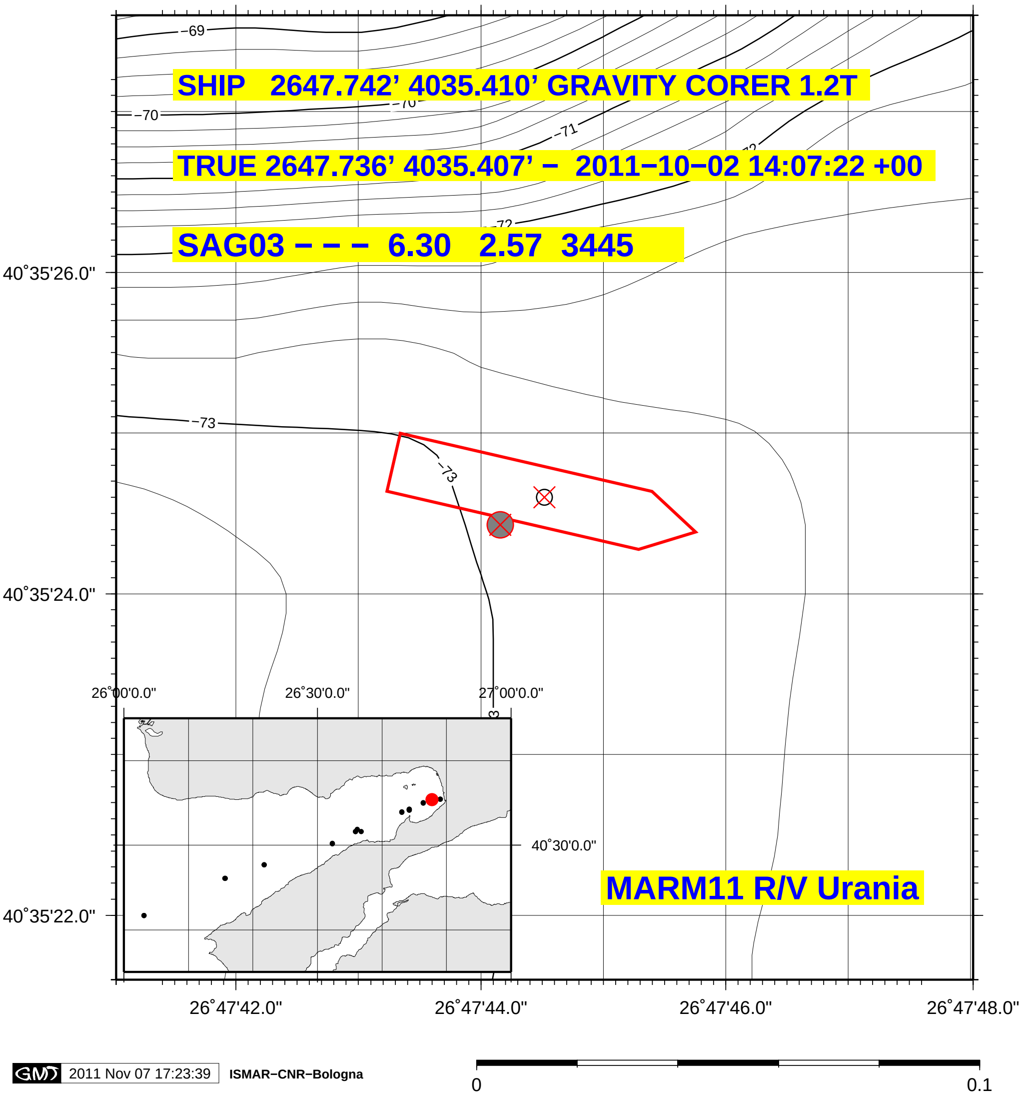

Figure 17: SAG03 positioning data.

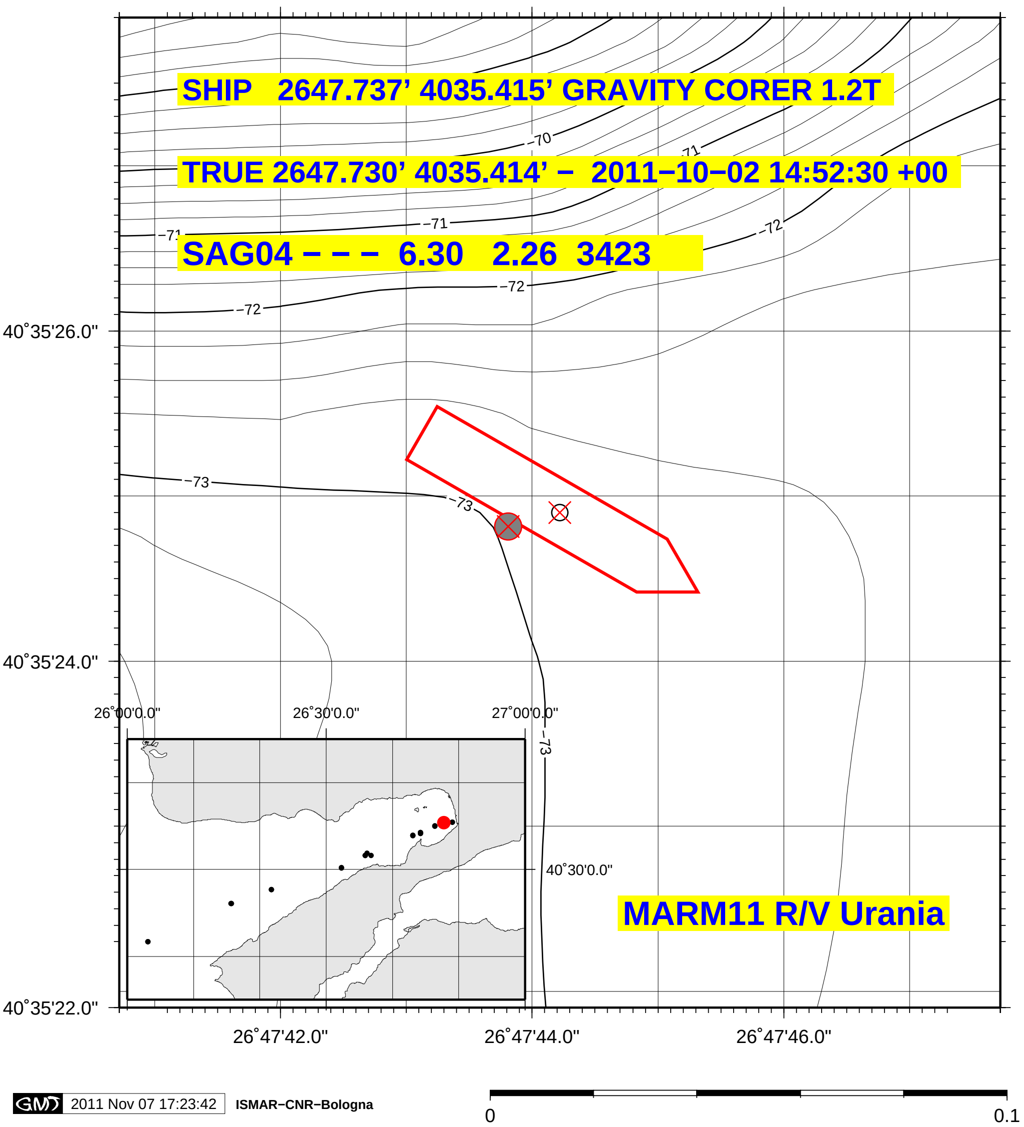

Figure 18: SAG04 positioning data.

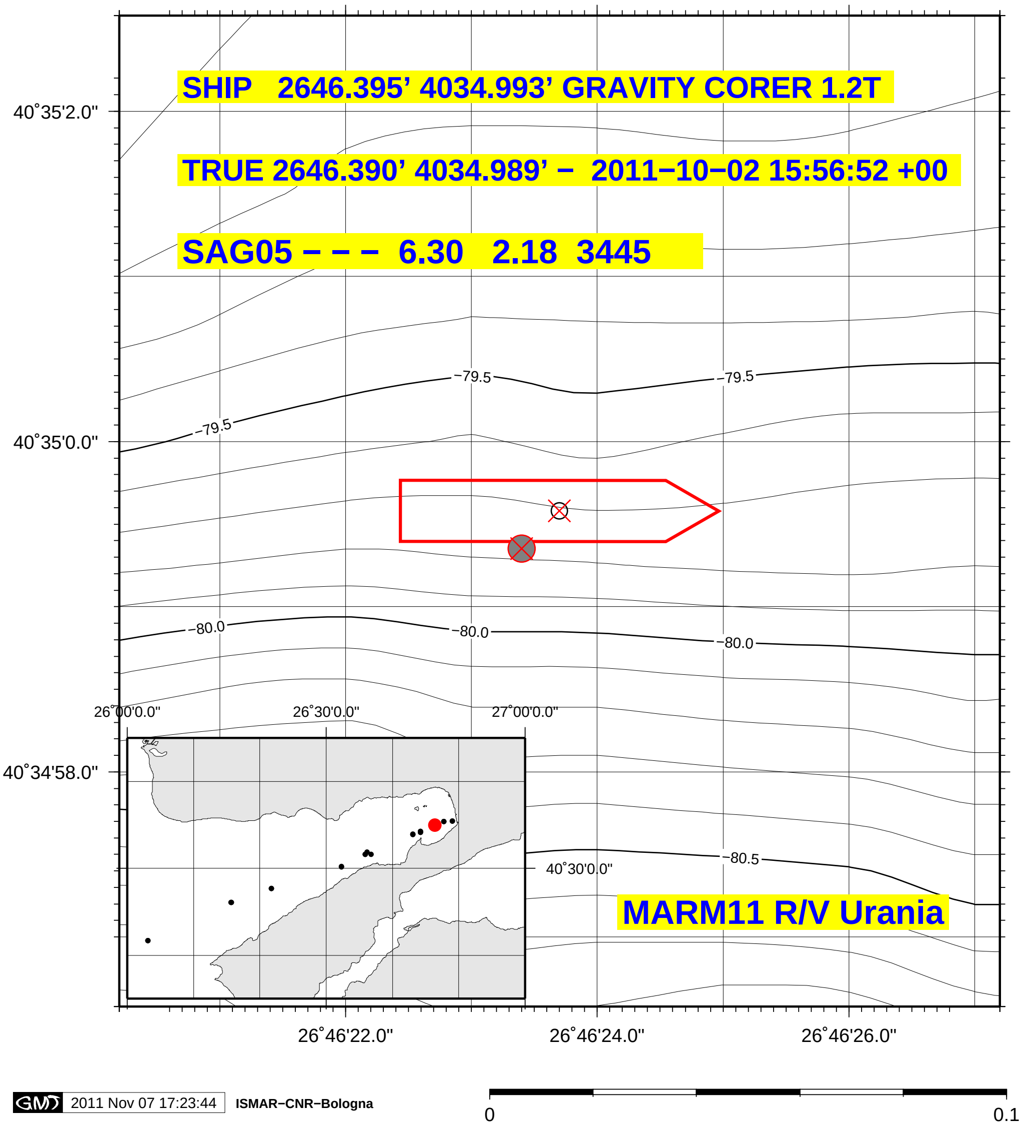

Figure 19: SAG05 positioning data.

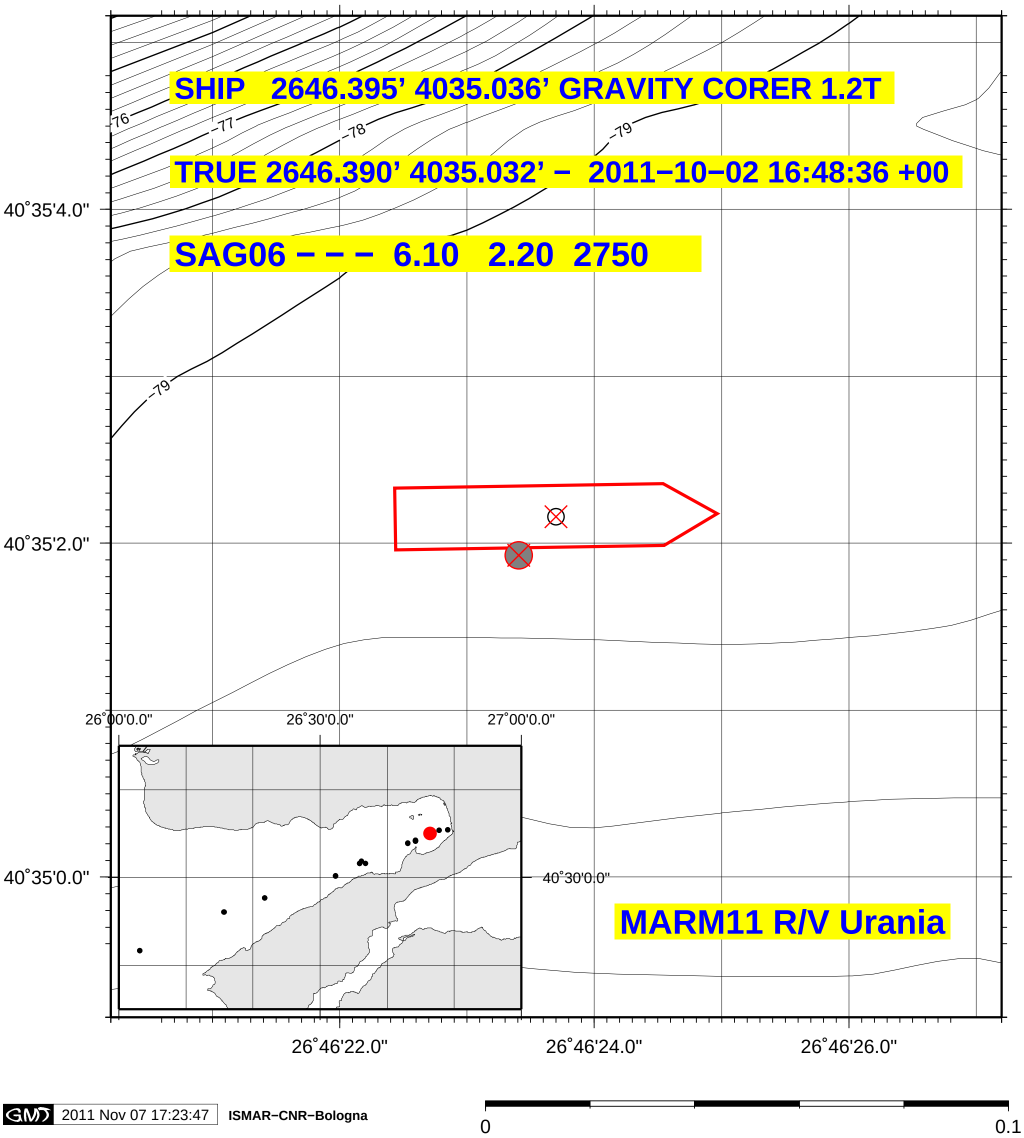

Figure 20: SAG06 positioning data.

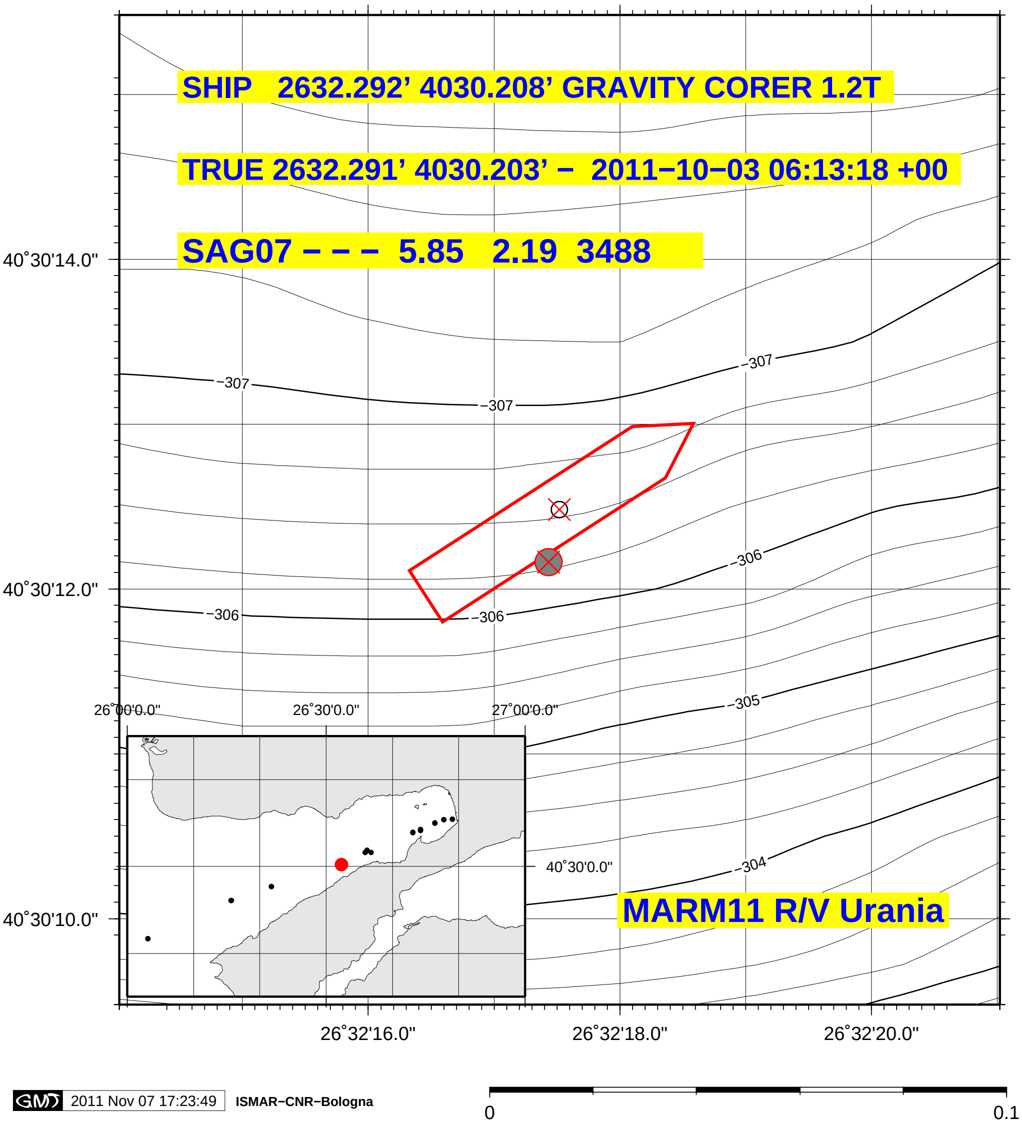

Figure 21: SAG07 positioning data.

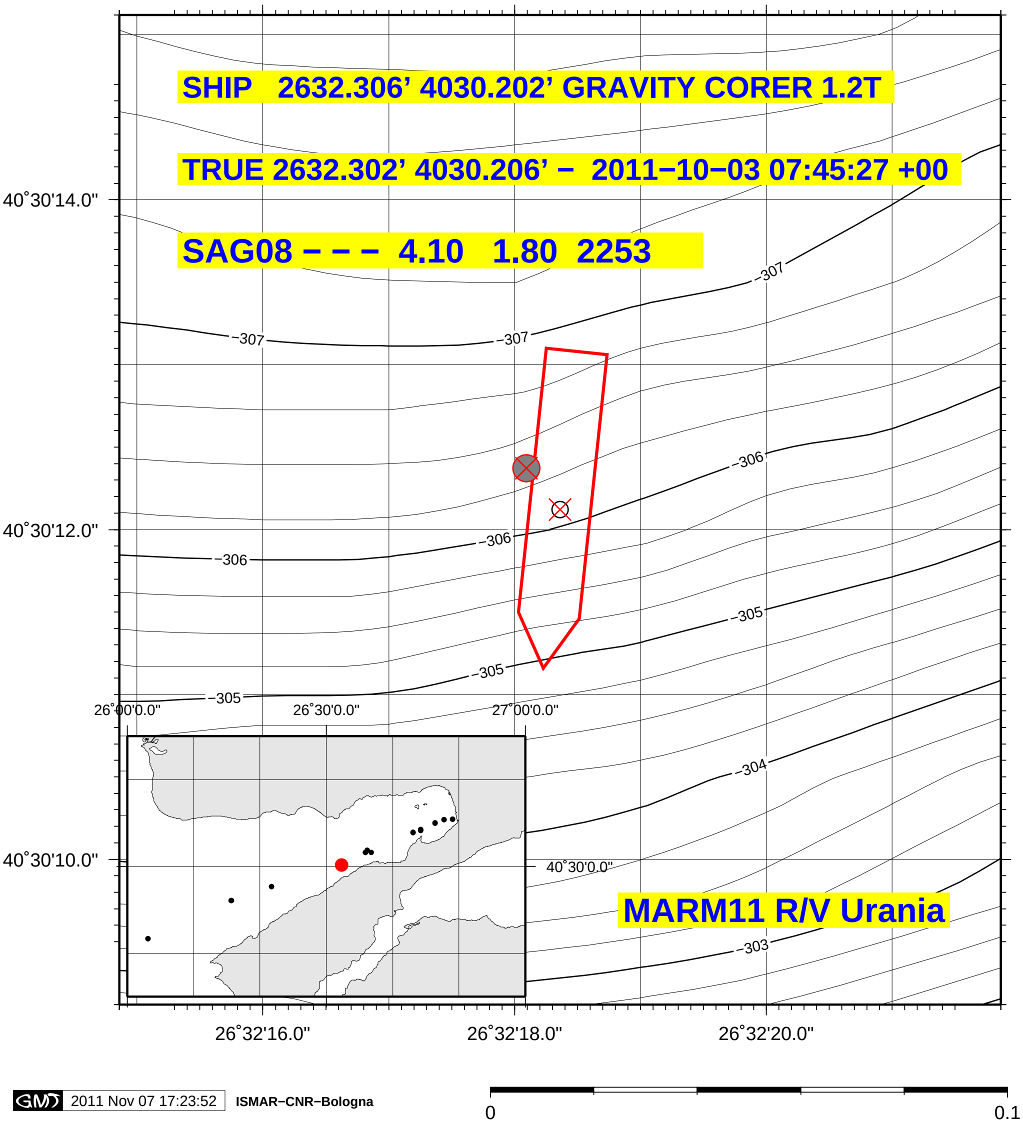

Figure 22: SAG08 positioning data.

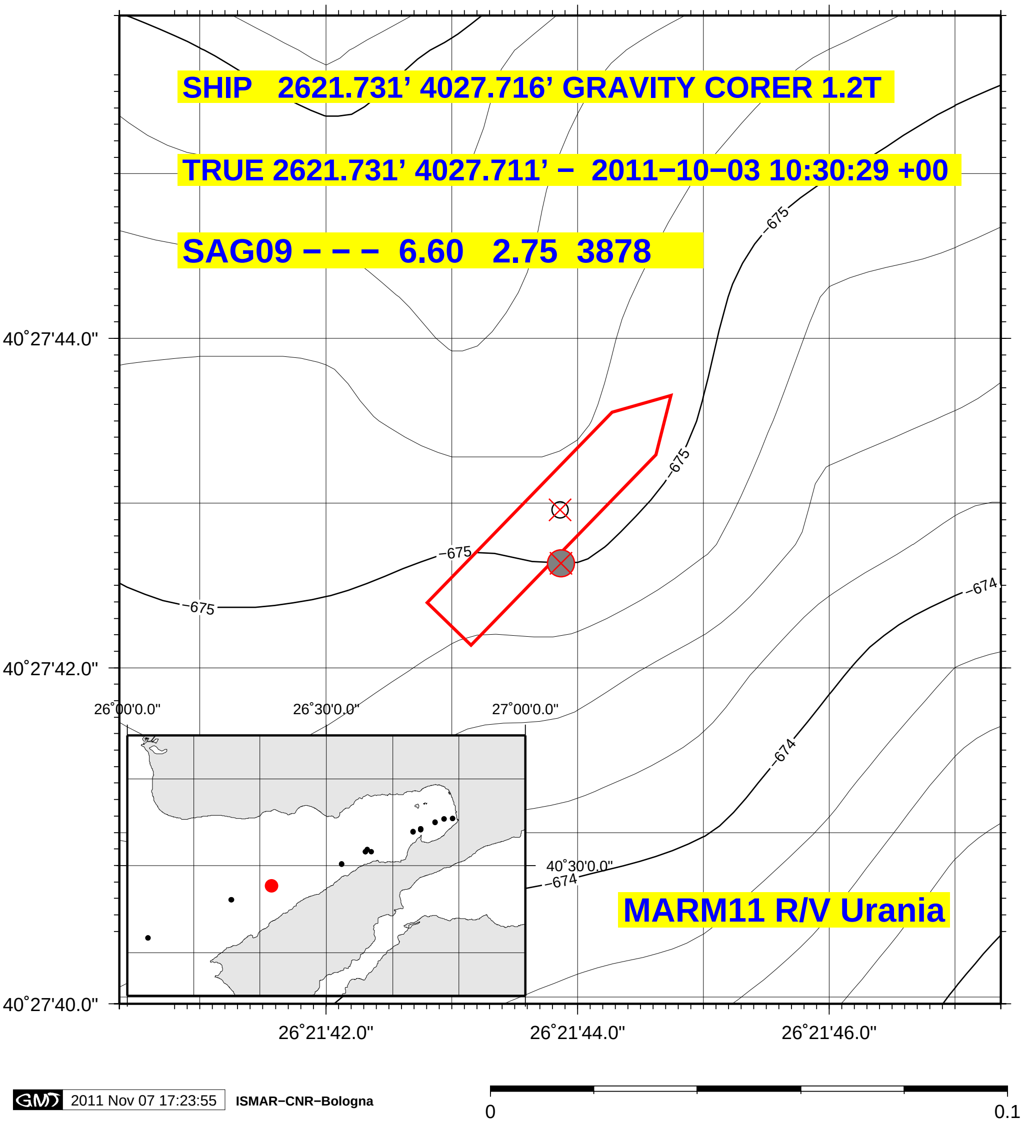

Figure 23: SAG09 positioning data.

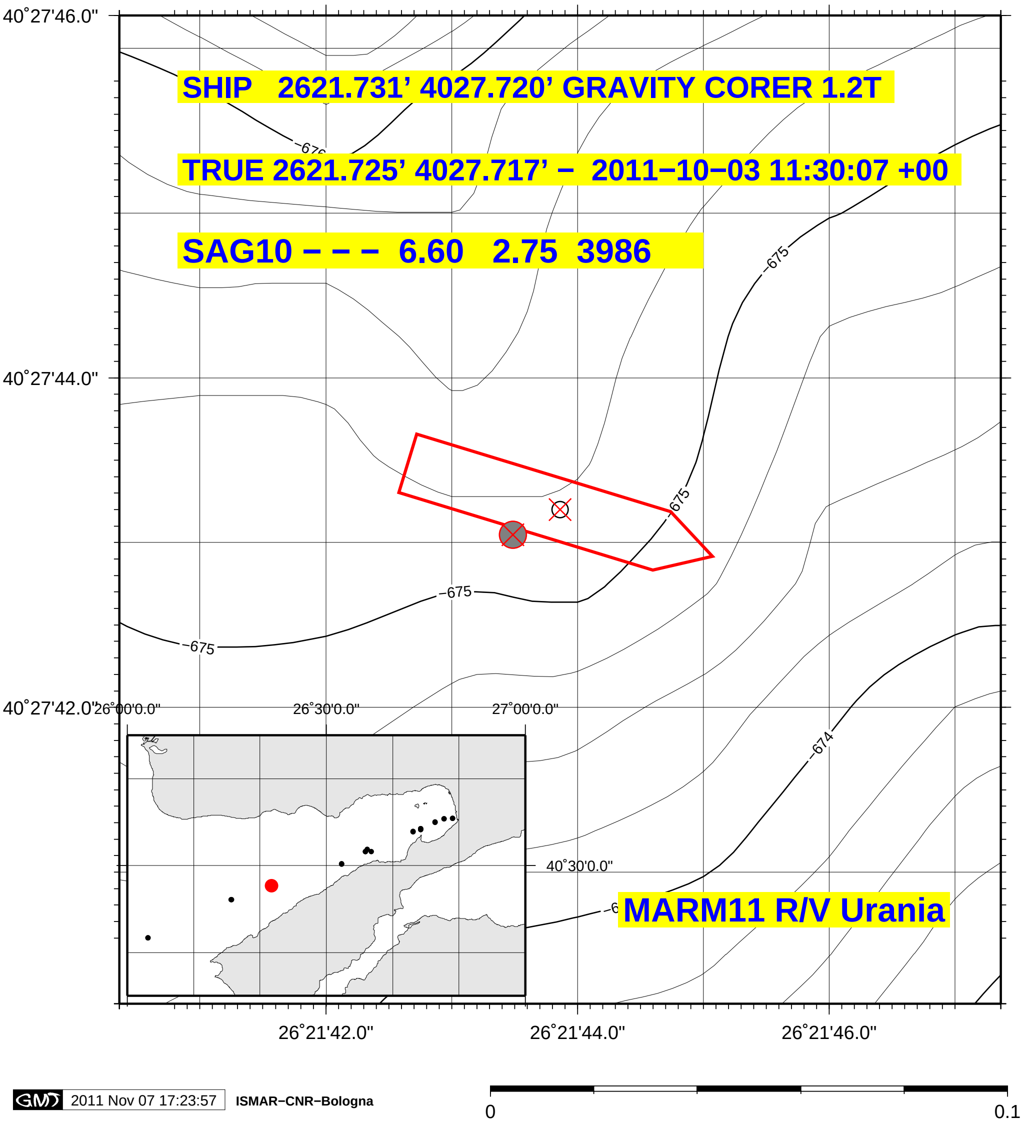

Figure 24: SAG10 positioning data.

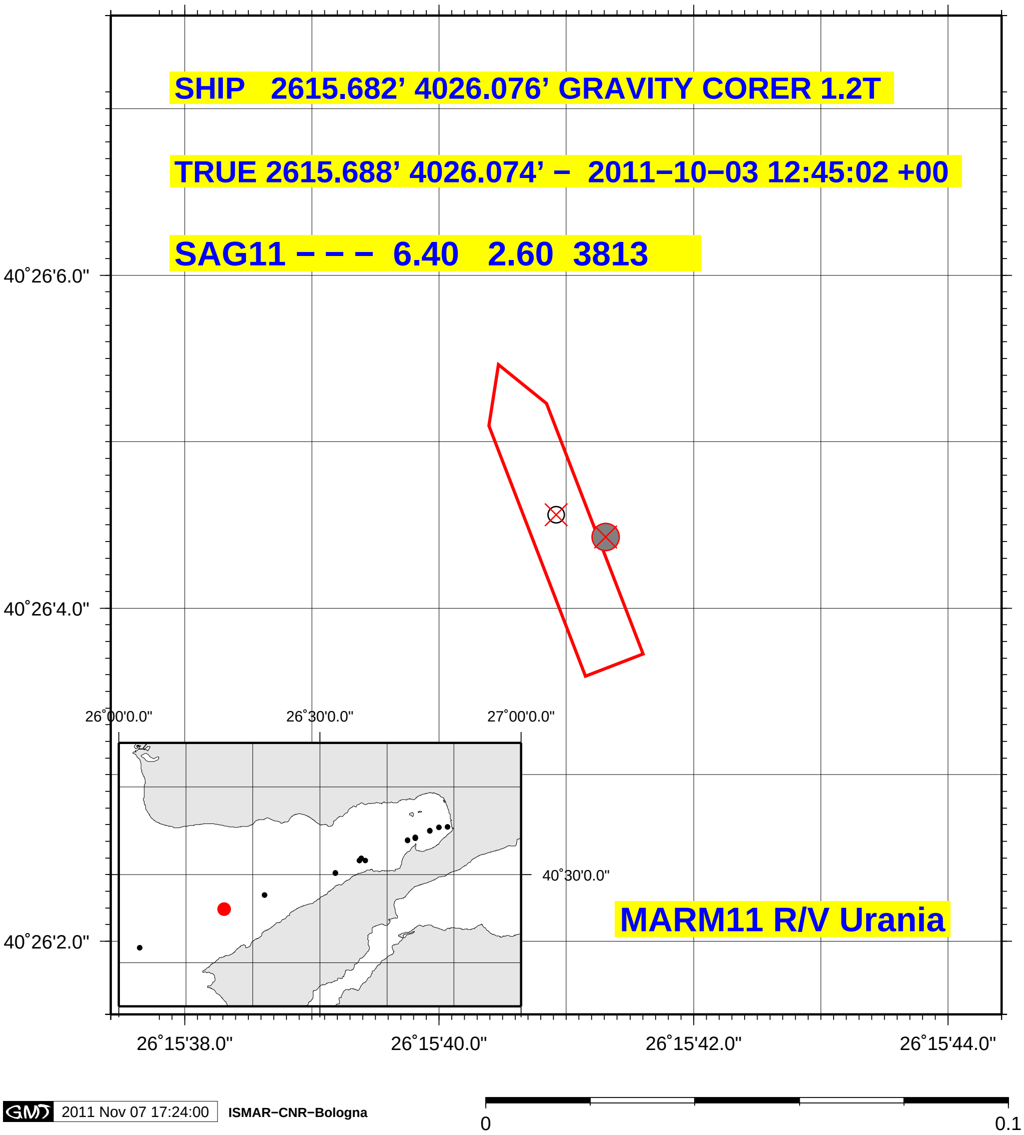

Figure 25: SAG11 positioning data.

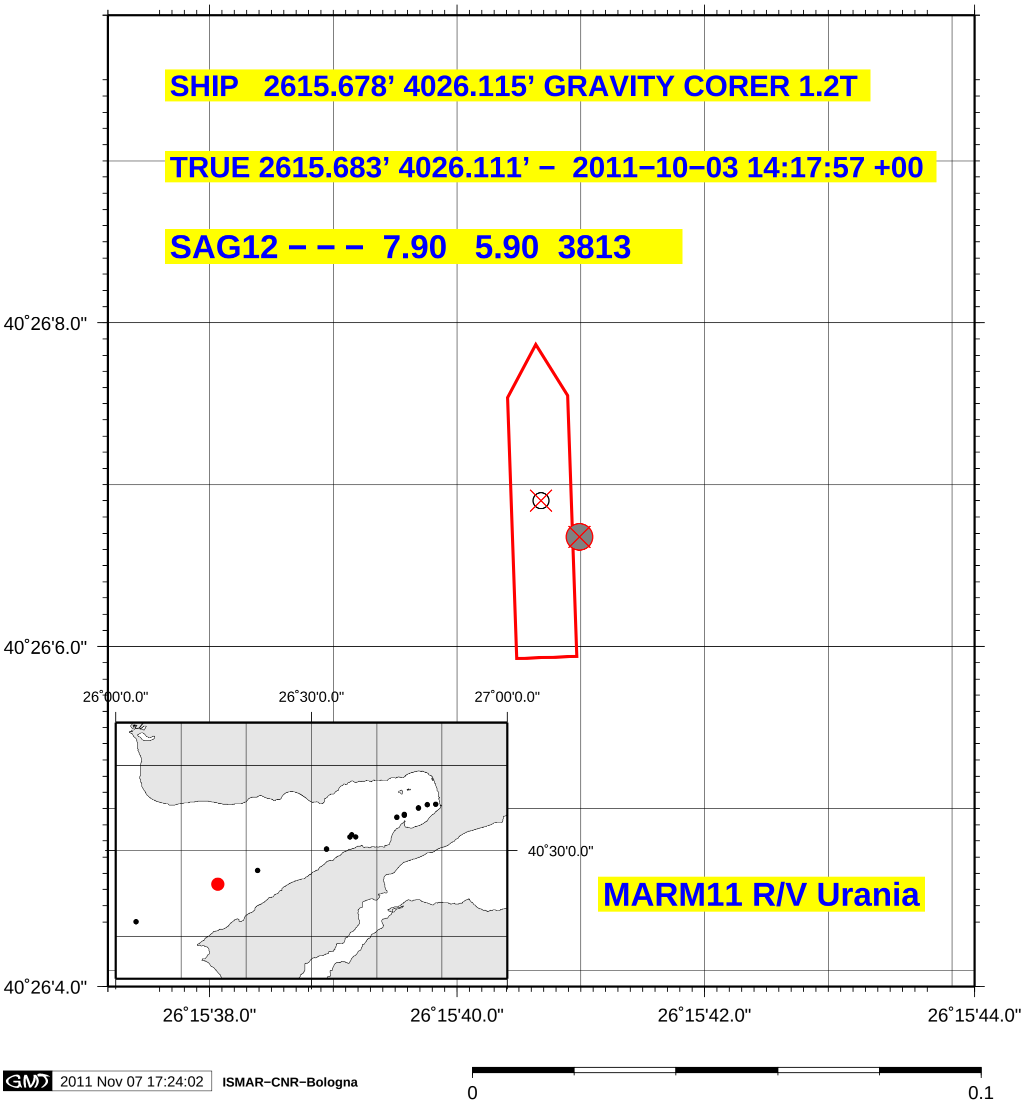

Figure 26: SAG12 positioning data.

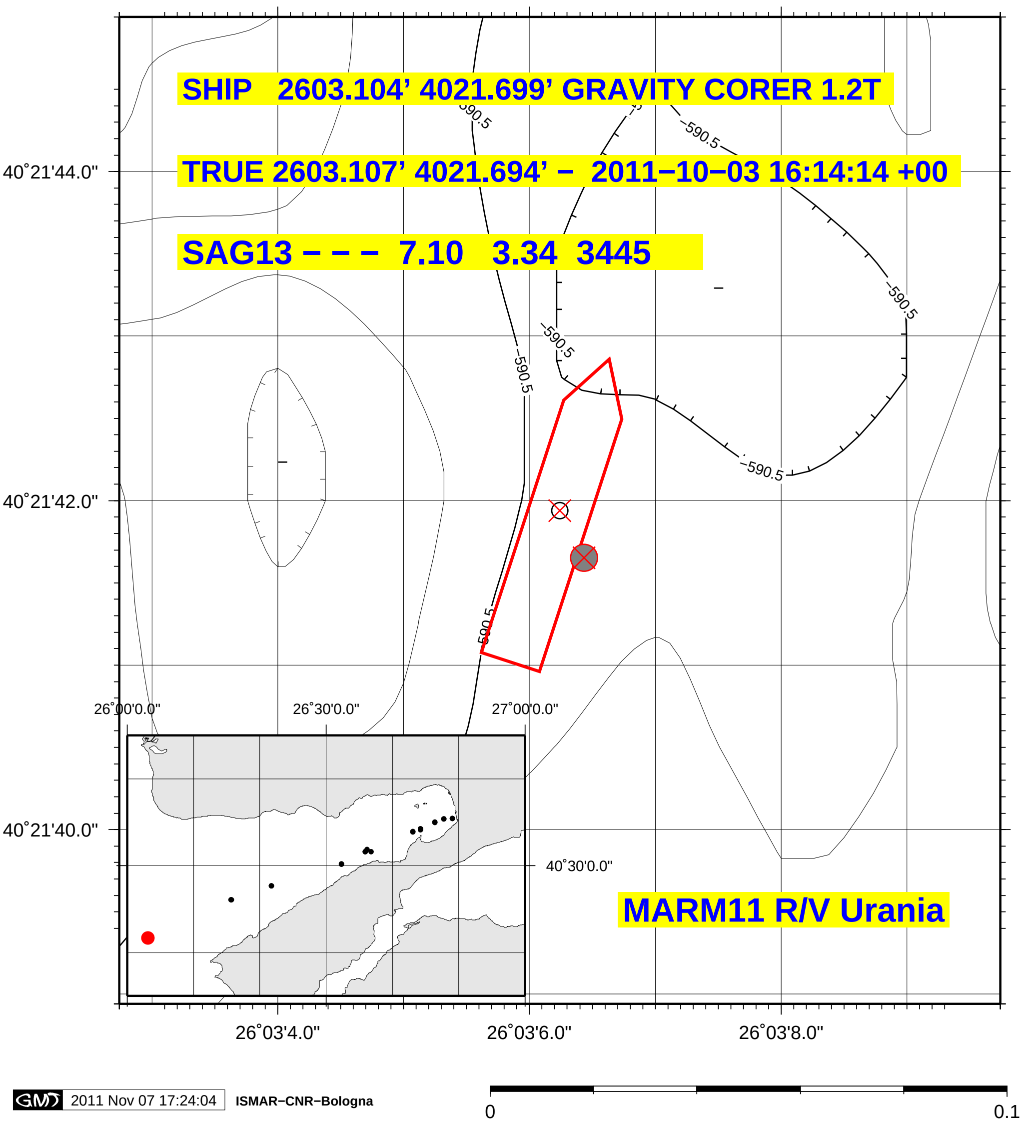

Figure 27: SAG13 positioning data.

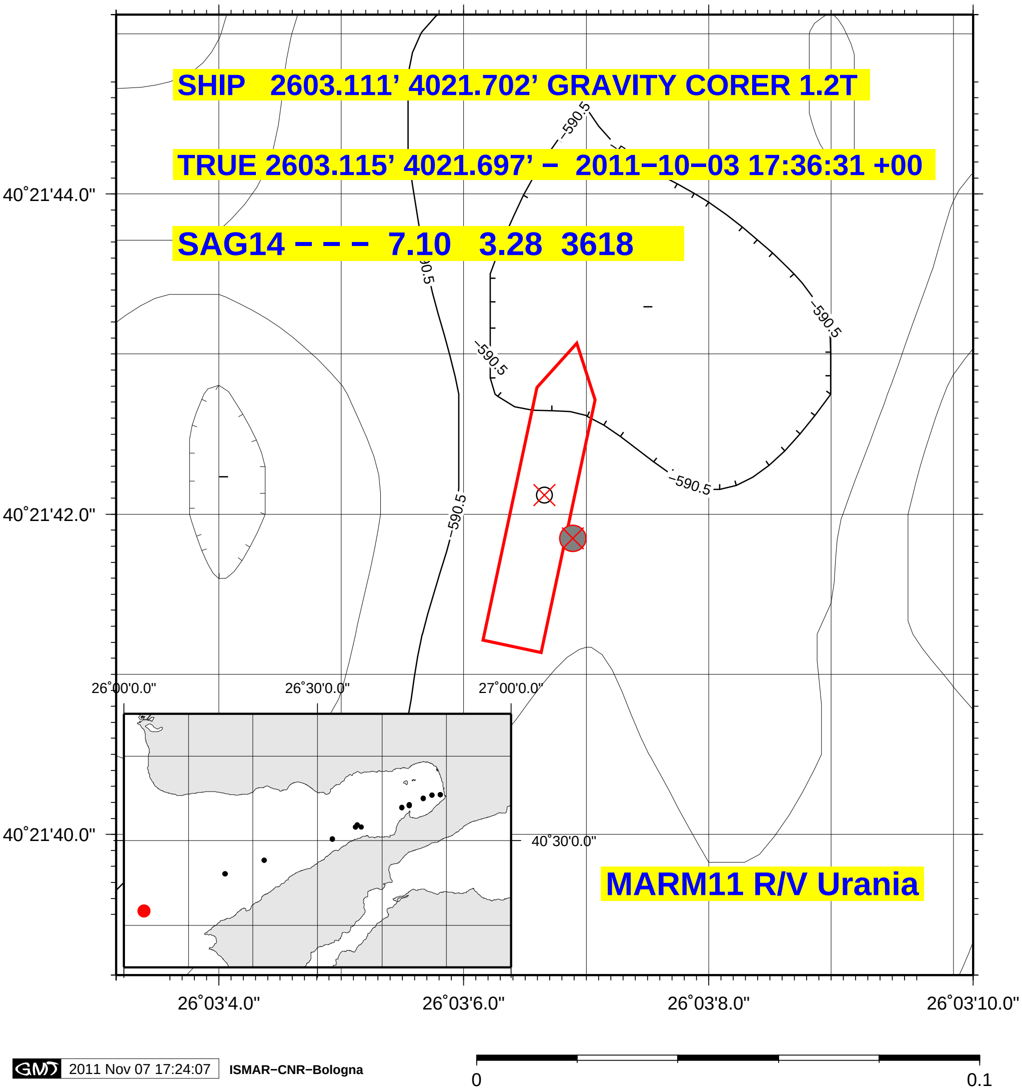

Figure 28: SAG14 positioning data.

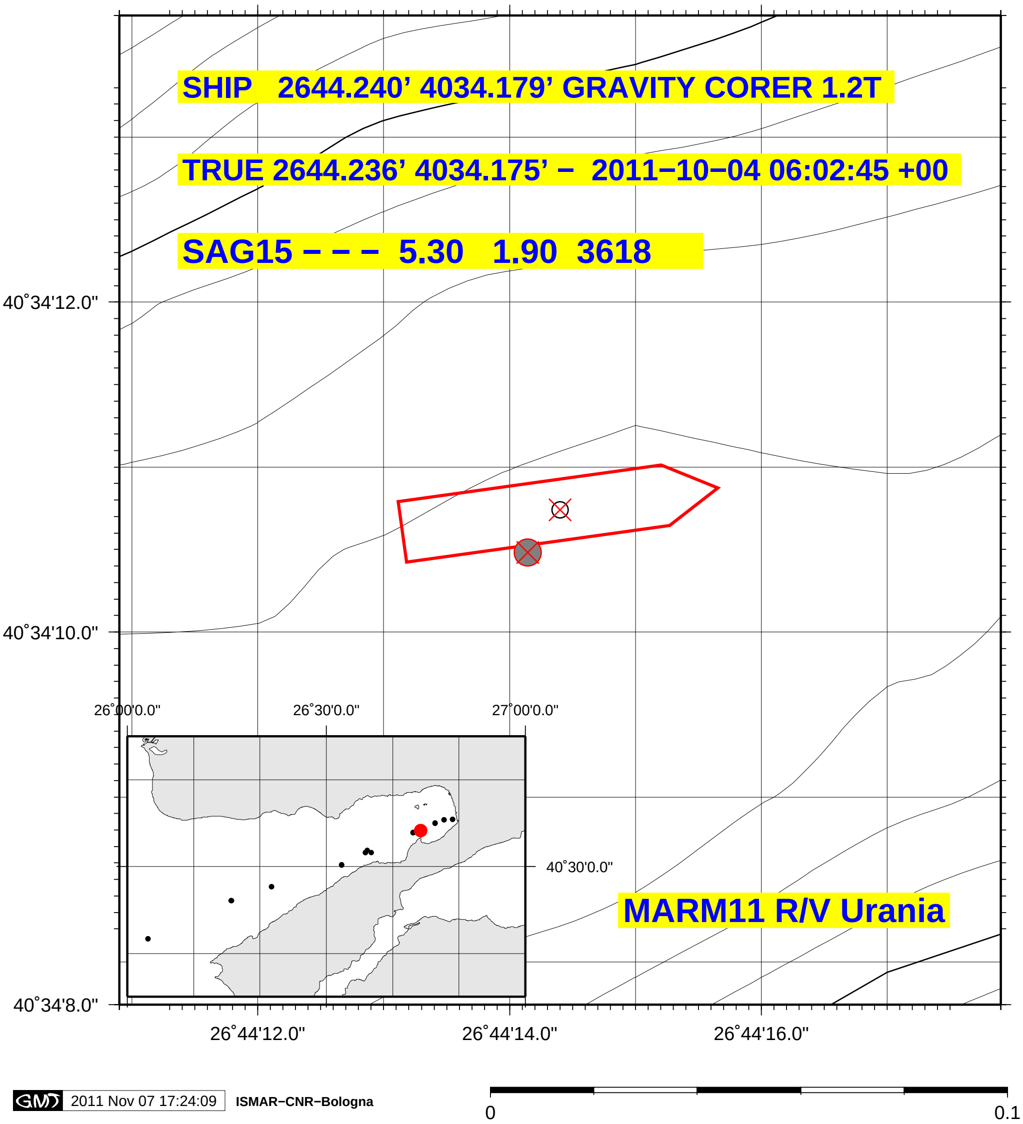

Figure 29: SAG15 positioning data.

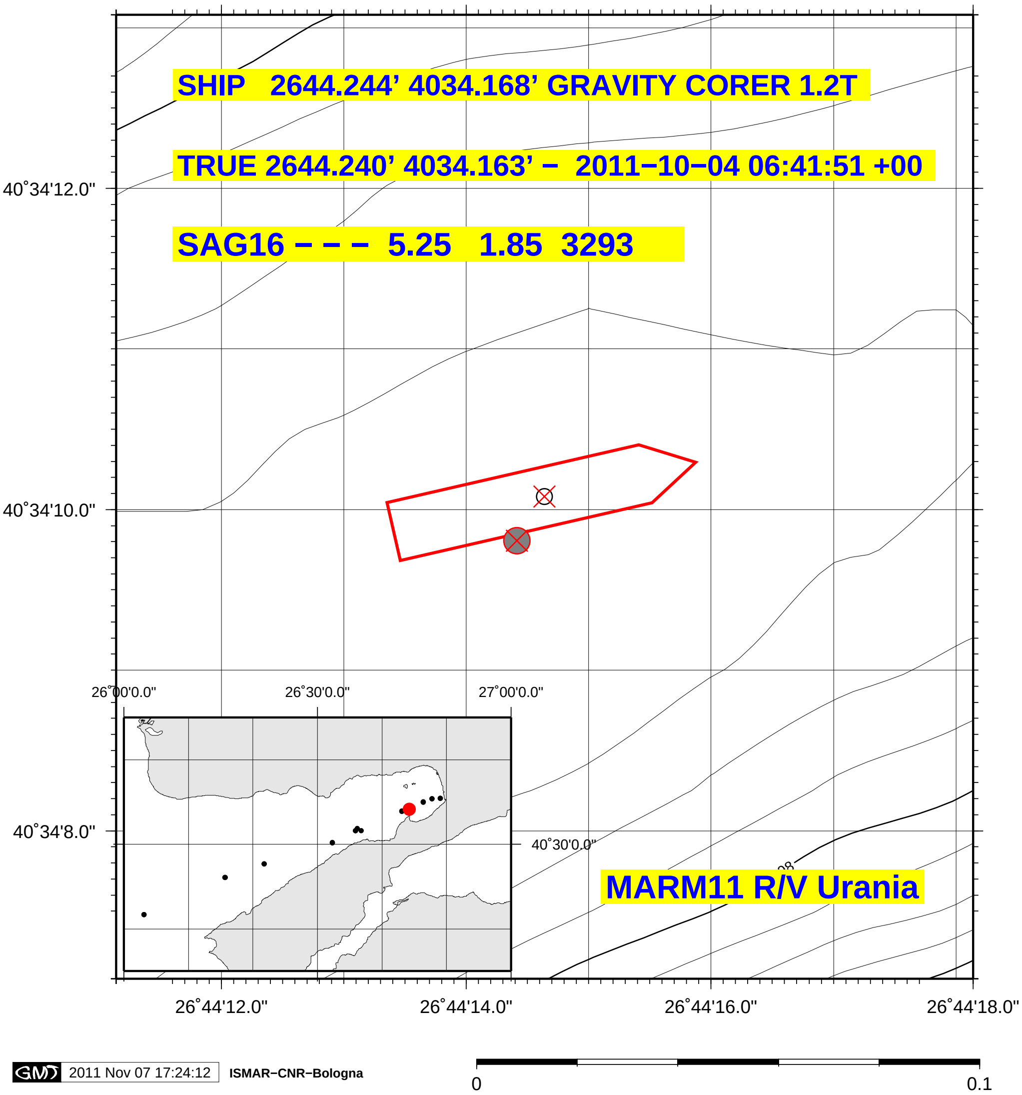

Figure 30: SAG16 positioning data.

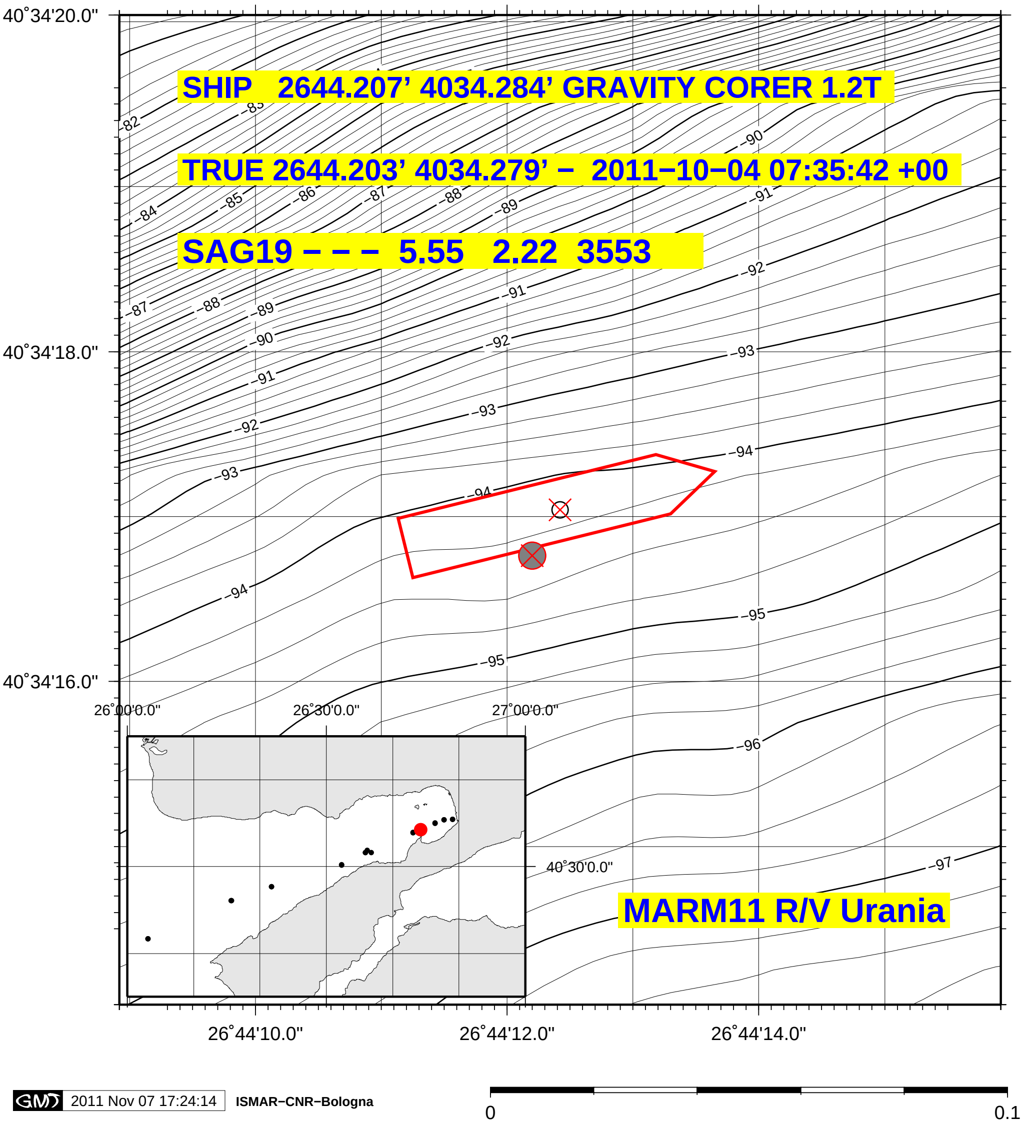

Figure 31: SAG19 positioning data.

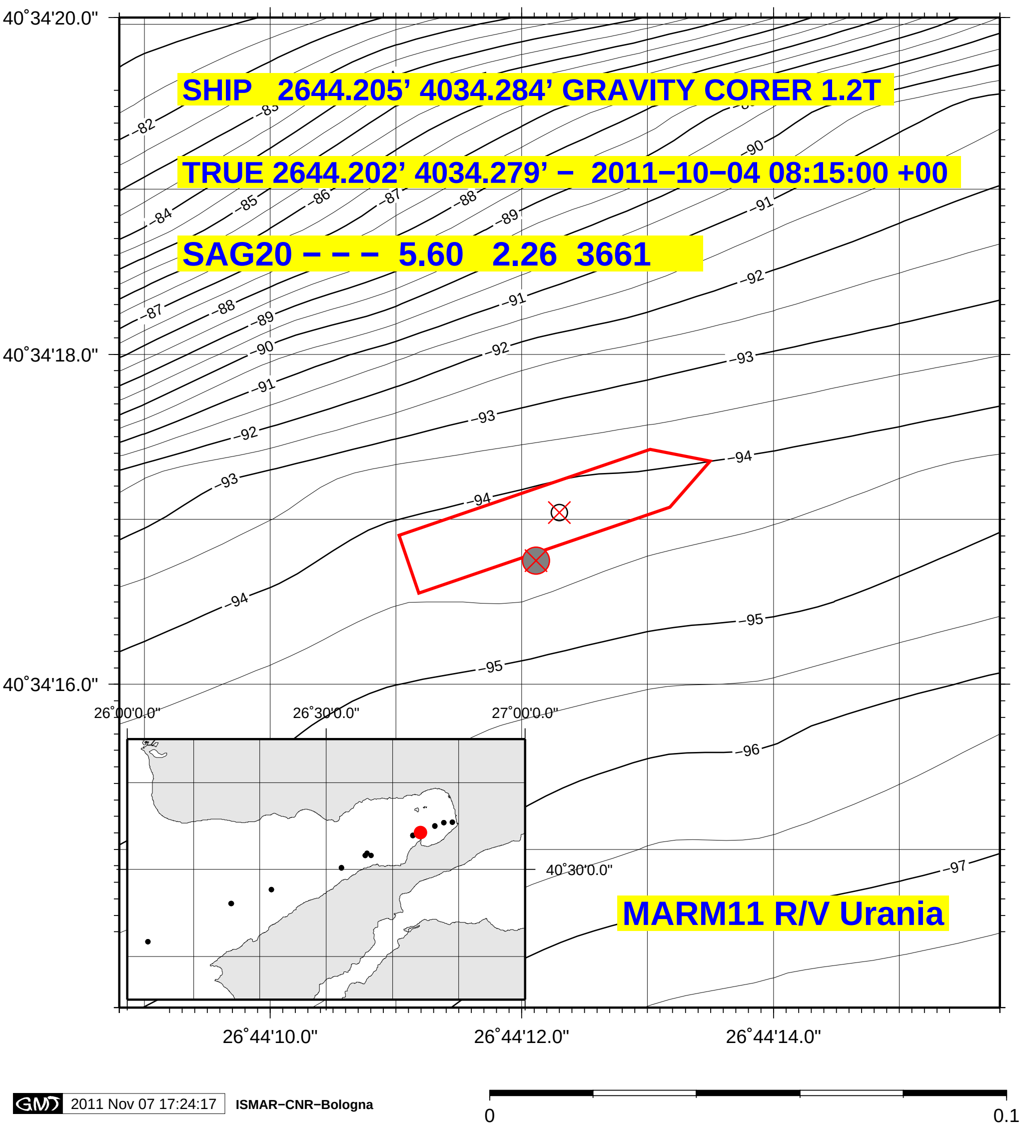

Figure 32: SAG20 positioning data.

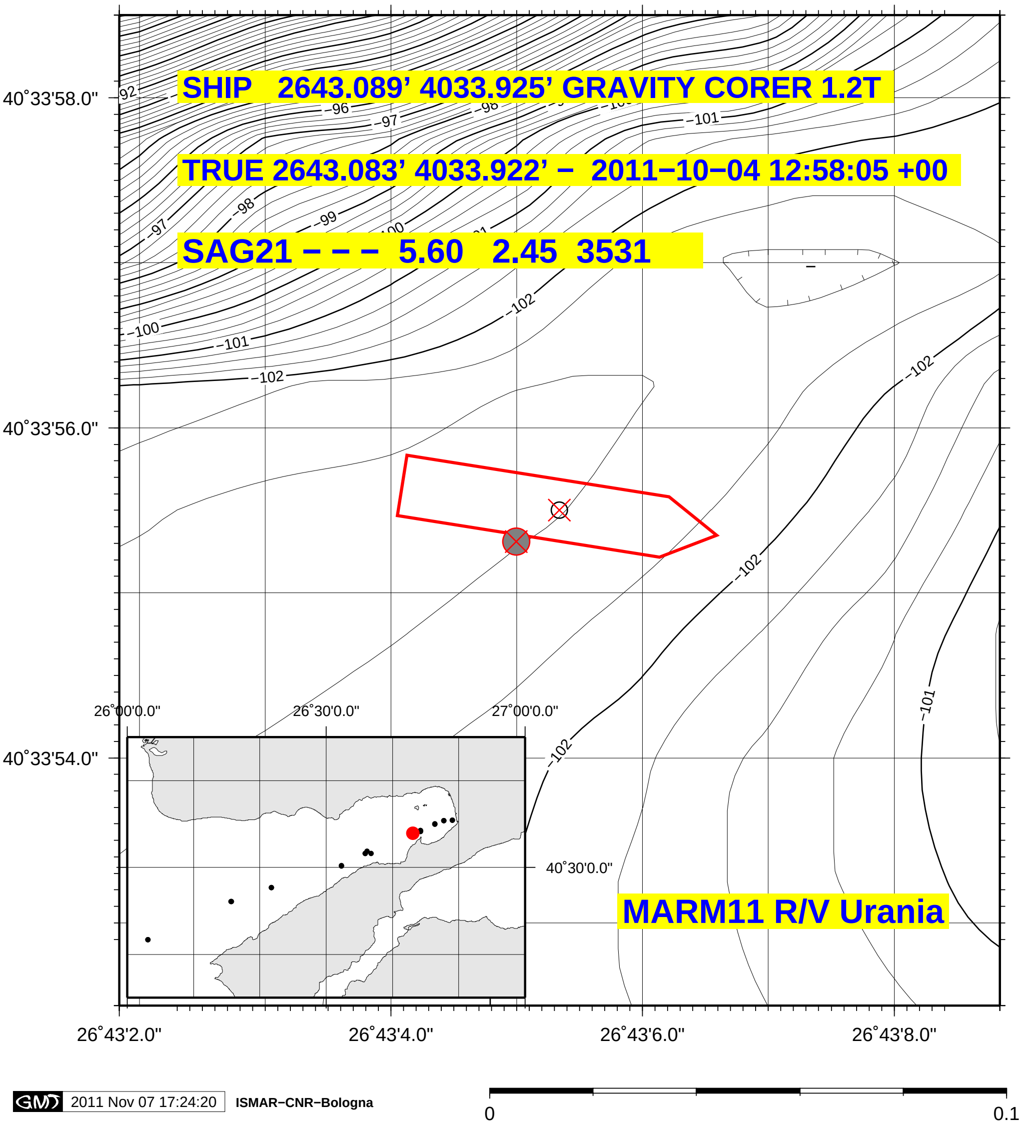

Figure 33: SAG21 positioning data.

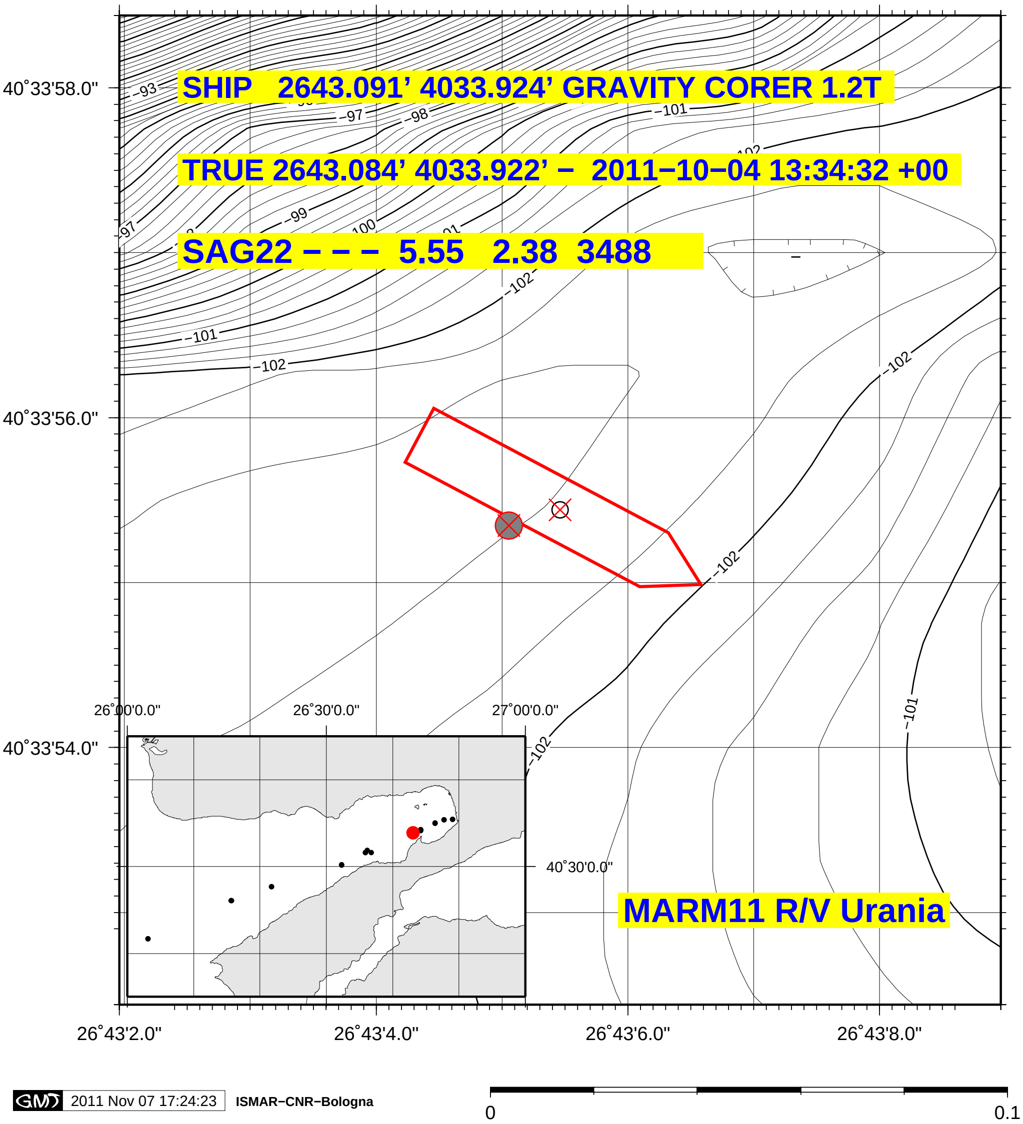

Figure 34: SAG22 positioning data.

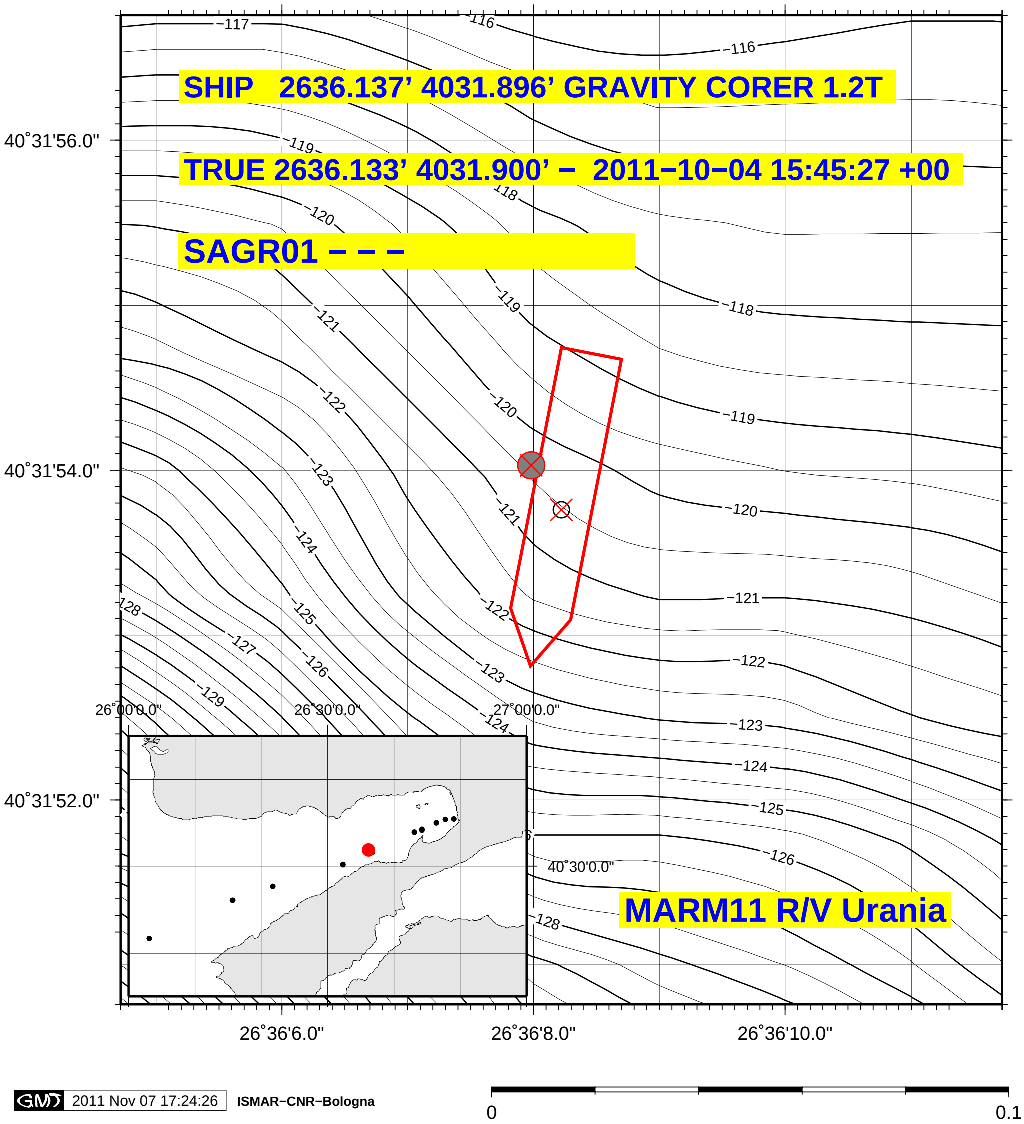

Figure 35: SAGR01 positioning data.

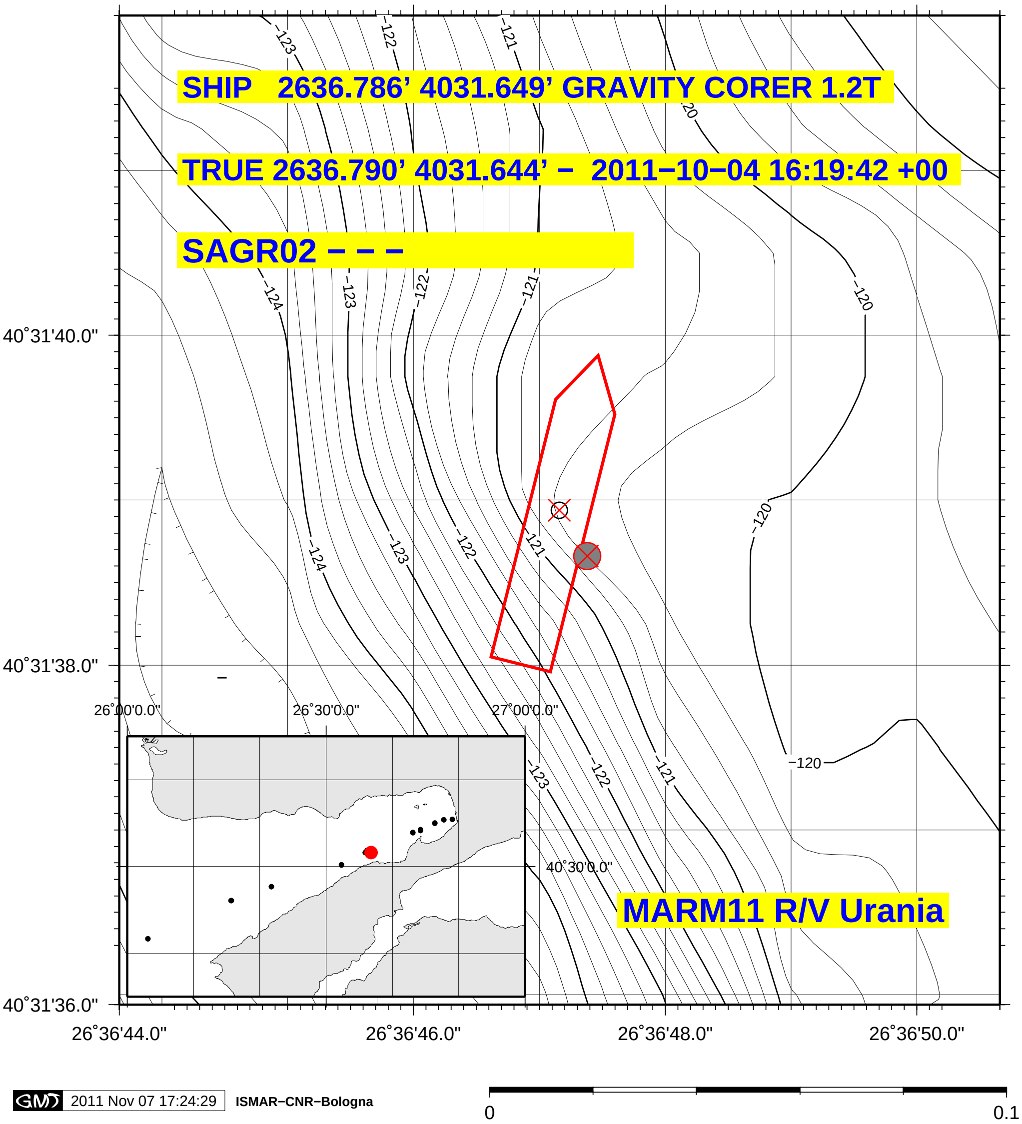

Figure 36: SAGR02 positioning data.

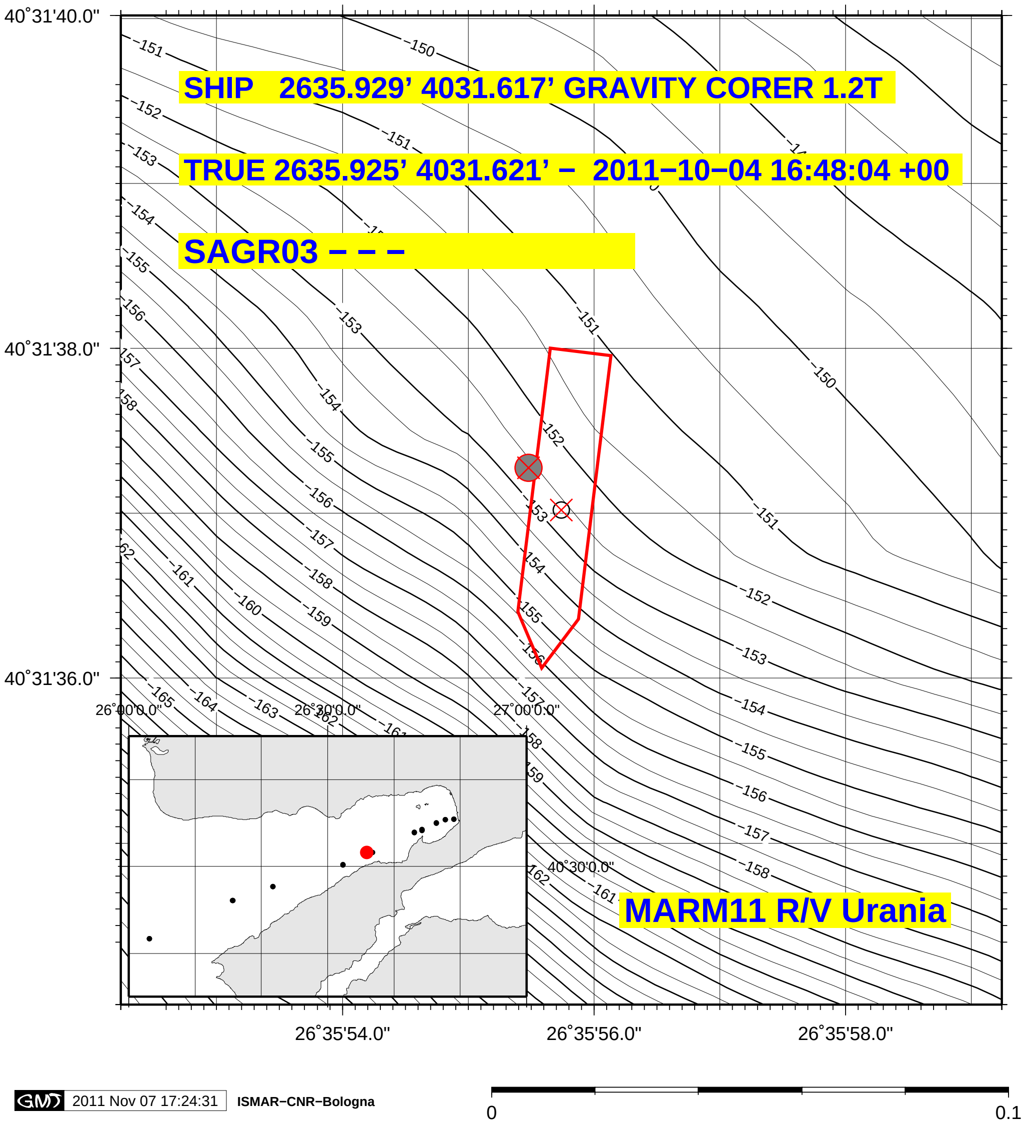

Figure 37: SAGR03 positioning data.

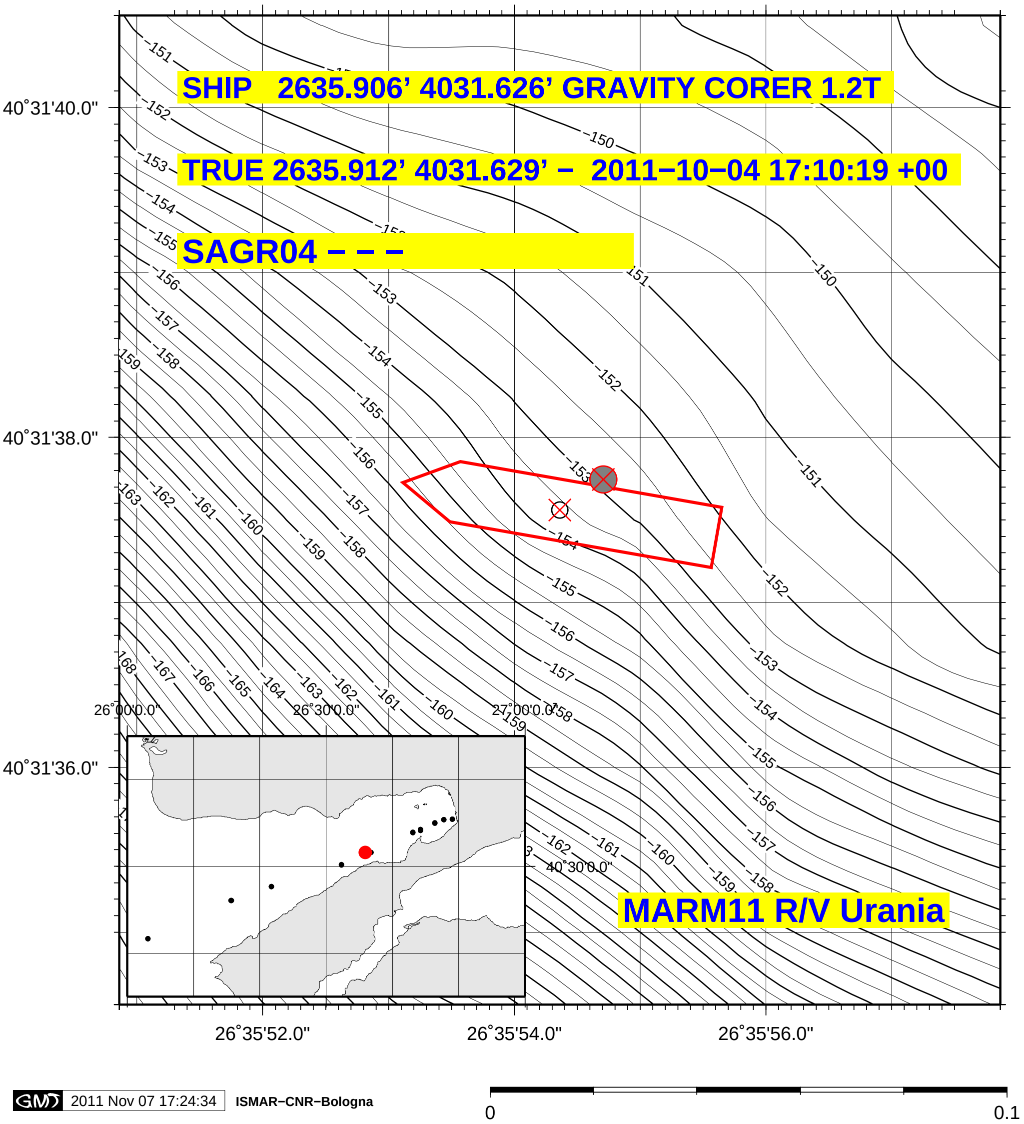

Figure 38: SAGR04 positioning data.