IODP Proposal Cover Sheet

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Hellenic Arc Volcanic Field

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Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
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Abstract

Subduction-related volcanism impacts life and the environment around the edges of continents. Better understanding of island-arc volcanism and associated hazards requires study of the processes that drive such volcanism, and how the volcanoes interact with their marine surroundings. What are the links and feedbacks between crustal tectonics, volcanic activity and magma genesis? What are the dynamics and impacts of submarine explosive volcanism and caldera-forming eruptions? How do calderas collapse during explosive eruptions, then recover to enter new magmatic cycles? What are the reactions of marine ecosystems to volcanic eruptions?

The Christiana-Santorini-Kolumbo (CSK) volcanic field on the Hellenic Volcanic arc is a unique system for addressing these questions. It consists of three large volcanic centres (Christiana, Santorini, Kolumbo), and a line of small submarine cones, founded on thinned continental crust in a 100-km-long rift zone that cuts across the island arc. The CSK volcanic field is notable for Santorini caldera and its Late Bronze Age eruption, an iconic event in both volcanology and archaeology. Kolumbo seamount erupted in 1650, causing many deaths from gas release and tsunami impact. The caldera unrest at Santorini in 2011-12 raised awareness of eruption threat at this major tourist destination.

The marine rift basins around the CSK field, as well as Santorini caldera, contain volcano-sedimentary fills up to several hundreds of metres thick, providing rich archives of CSK volcanic products, tectonic evolution, magma genesis and palaeo-environments accessible only by deep drilling backed up by seismic interpretations. We propose to drill four primary sites in the rifts basins and two additional primary sites inside Santorini caldera. The science has five main objectives, each with a leading testable hypothesis, and two secondary objectives. The proposal addresses all three science themes, and six of the fourteen challenges, of the IODP Science plan.

Existing onland volcanological research, sea-floor mapping, shallow coring and dredge sampling, combined with a dense network of seismic profiles and a recent seismic tomography experiment, make drilling at the CSK volcanic field very timely. Deep drilling is essential to identify, characterise and interpret depositional packages visible on seismic images, to chemically correlate primary volcaniclastic layers in the rift fills with their source volcanoes, to fill in the many gaps in the onland volcanic records, to provide a tight chronostratigraphic framework for rift tectonic and sedimentary histories, and to sample deep subsurface microbial life.

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Scientific Objectives

We propose six sites (and associated alternate sites) for deep-sea drilling at the rift-hosted Christiana-Santorini-Kolumbo (CSK) volcanic field on the Hellenic island arc in Greece, with five primary objectives:

1. Arc volcanism in an active rift environment: To reconstruct the volcanic history of the CSK volcanic field since the Pliocene by exploiting a >3.8 My marine volcano-sedimentary archive [IODP Science Plan challenges 11, 12].

2. The volcano-tectonic connection: To reconstruct the subsidence and tectonic histories of the rift basins, and use the rift as a natural experiment for studying the relationship between CSK volcanism and major crustal tectonic events [challenges 11, 12].

3. Arc magmatism in a region of extending crust: To document magma petrogenesis at the CSK volcanic field in space and time, and to seek effects of crustal thinning on magma storage, differentiation and crustal contamination [challenges 8, 11].

4. Unravelling an iconic caldera-forming eruption: To document the processes, products and potential impacts of the late Bronze-Age eruption of Santorini [challenge 12].

5. Volcanic hazards from submarine silicic eruptions: To study the histories, dynamics and hazards of Kameni and Kolumbo submarine volcanoes [challenge 12].

Each objective is presented with a leading hypothesis, the testing of which requires ocean drilling and detailed core analysis. We also include two secondary drilling objectives: 6. Transition from continental to marine environments in the southern Aegean [challenge 11]; 7. Biological systems reactions to volcanic eruptions and seawater acidification [challenges 5, 6, 7]

Non-standard measurements technology needed to achieve the proposed scientific objectives

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Proposed Sites (Total proposed sites: 19; pri: 6; alt: 13; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
CSK-01A (Primary)	36.7293 25.6482	489	756	9	765	CSK-01A targets the plio-quaternay volcano-sedimentary fill of the Anhydros Basin, to the depth of the Alpine basement. The site lies near the basin axis in a position downstream of Santorini and Kolumbo Volcanoes. The aim is to use the core (and seismic profiles) to reconstruct the volcanic, sedimentary and tectonic histories of the basin, and to access a near-continuous time series of volcanism in the area since rift inception. The hole will transect and characterize all six seismic packages of the Anhydros rift basin (B1 to B6).
CSK-02A (Alternate)	36.7438 25.7146	488	437	10	447	CSK-02A targets the plio-quaternay volcano-sedimentary fill of the Anhydros Basin, to the depth of the Alpine basement. The site lies near the basin axis in a position downstream of Santorini and Kolumbo Volcanoes. The aim is to use the core (and seismic profiles) to reconstruct the volcanic, sedimentary and tectonic histories of the basin, and to access a near-continuous time series of volcanism in the area since rift inception. The hole will transect and characterize all six seismic packages of the Anhydros rift basin (B1 to B6).
CSK-03A (Primary)	36.5549 25.4398	397	566	0	566	CSK-03A lies in the Anhydros Basin on the NW submarine flank of Kolumbo Volcano. The aim is to penetrate four seismically recognized volcanic eruption units from Kolumbo (K2, K3, K5 and the thin lateral continuation of K1), as well as many eruption units from Santorini. This will enable characterisation of the products of the Kolumbo eruptions, as well as construction of a coherent stratigraphy for Santorini and Kolumbo together. The site is placed sufficiently away from Kolumbo vent in order to avoid possible coarse, bouldery facies of the eruption units.
CSK-04A (Alternate)	36.5728 25.4092	402	545	0	545	CSK-04A lies in the Anhydros Basin on the NW submarine flank of Kolumbo Seamount Volcano. The aim is to penetrate seismically recognized volcanic eruption units from Kolumbo, as well as many units from Santorini. This will enable characterisation of the products of the Kolumbo eruptions, as well as construction of a coherent stratigraphy for Santorini and Kolumbo together. However this site only clearly transects one Kolumbo eruption unit (K5), and has been replaced by site CSK-21A, which is better placed for our objectives. We retain CSK-04A, as it may transect thin distal equivalents of K1-K5.
CSK-05B (Primary)	36.4356 25.3806	385	360	0	360	CSK-05B is sited in the northern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them and confirm (or not) published hypotheses, as well as to penetrate below unit S3 (probably intracaldera tuff of the LBA eruption). The hole is located north of a low-velocity seismic anomaly detected by the PROTEUS seismic tomography experiments and centered on the focus of caldera floor uplift during the unrest period of 2011-12. It replaces hole CSK-05A in FULL.
CSK-06B (Alternate)	36.4423 25.3752	383	360	0	360	CSK-06B is sited in the northern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them and confirm (or not) published hypotheses, as well as to penetrate below unit S3 (probably intracaldera tuff of the LBA eruption). It replaces site CSK-06A in FULL.
CSK-07B (Primary)	36.38895 25.41713	292	360	0	360	CSK-07B is sited in the southern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them, as well as to penetrate below unit S3 (probable intracaldera tuff of the LBA eruption). This site is complementary to sites CSK-05B/06B in the northern caldera basin, as together they will provide a complete understanding of the caldera fill and collapse history. It replaces site CSK-07A in FULL.
CSK-08B (Alternate)	36.38161 25.40606	293	375	0	375	CSK-08B is sited in the southern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them, as well as to penetrate below unit S3 (probable intracaldera tuff of the LBA eruption). This site is complementary to sites CSK-05B/06B in the northern caldera basin, as together they will provide a complete understanding of the caldera fill and collapse history. Site CSK-08 replaces CSK-08A in FULL.
CSK-09A (Primary)	36.5656 25.7613	694	585	10	595	CSK-09A is sited in the Anafi Basin. The aim is to penetrate the entire volcano-sedimentary fill of this basin as far as the Alpine basement. The basin potentially records the full volcanic history of Santorini (and any older centres) since rift inception, but not of Kolumbo Volcano. The hole will reconstruct the subsidence and sedimentary history of this basin, to compare with that of the Anhydros Basin. It will transect all six seismic units present in the basin (B1 to B6).

Proposed Sites (Continued; total proposed sites: 19; pri: 6; alt: 13; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
CSK-10A (Alternate)	36.5494 25.7714	672	367	10	377	CSK-10A is sited in the Anafi Basin. The aim is to penetrate the entire volcano-sedimentary fill of this basin as far as the Alpine basement. The basin potentially records the full volcanic history of Santorini (and any older centres) since rift inception, but not of Kolumbo Volcano. The hole will reconstruct the subsidence and sedimentary history of this basin, to compare with that of the Anhydros Basin. It will transect the topmost five of the six seismic units present in the basin (B2 to B6).
CSK-13A (Primary)	36.3243 25.1826	489	847	10	857	CSK-13A is sited in the Christiana Basin. This basin is deeper than the Anhydros and Anafi Basins, and is located SW of Santorini. Its volcano-sedimentary fill potentially records the earlier volcanic history of the CSK volcanic field (including the products of Christiana and early Santorini), as well as younger Santorini and possibly Milos Volcano. The hole will pass through alternating volcanic units, including volcaniclastics from Santorini (marine unitsTh1-3, with three possible pyroclastic flow deposits Pf1-3), and volcaniclastics from Christiana (Ch1, 2), to the pre-volcanic basement.
CSK-14A (Alternate)	36.3049 25.1286	523	746	10	756	CSK-14A is sited in the Christiana Basin. This basin is deeper than the Anhydros and Anafi Basins, and is located SW of Santorini. Its volcano-sedimentary fill potentially records the earlier volcanic history of the CSK volcanic field (including the products of Christiana and early Santorini), as well as younger Santorini and possibly Milos Volcano. The hole will pass through alternating volcanic units, including volcaniclastics from Santorini (marine unitsTh1-3, with three possible pyroclastic flow deposits Pf1-3), and volcaniclastics from Christiana (Ch1, 2), to the pre-volcanic basement.
CSK-15A (Alternate)	36.7320 25.6463	490	790	10	800	CSK-15A targets the plio-quaternay volcano-sedimentary fill of the Anhydros Basin, to the depth of the Alpine basement. The site lies near the basin axis in a position downstream of Santorini and Kolumbo Volcanoes. The aim is to use the core (and seismic profiles) to reconstruct the volcanic, sedimentary and tectonic histories of the basin, and to access a near-continuous time series of volcanism in the area since rift inception. The hole will transect and characterize all six seismic packages of the Anhydros rift basin (B1 to B6).
CSK-16A (Alternate)	36.5480 25.4517	372	565	0	565	CSK-16A lies in the Anhydros Basin on the NW submarine flank of Kolumbo Volcano. The aim is to penetrate four seismically recognized volcanic eruption units from Kolumbo (K2, K3, K5 and the thin lateral continuation of K1), as well as many eruption units from Santorini. This will enable characterisation of the products of the Kolumbo eruptions, as well as construction of a coherent stratigraphy for Santorini and Kolumbo together.
CSK-17A (Alternate)	36.4339 25.3819	386	420	0	420	CSK-17A is sited in the northern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them and confirm (or not) published hypotheses, as well as to penetrate below unit S3 (probably intracaldera tuff of the LBA eruption). The hole is located north of a low-velocity seismic anomaly detected by the PROTEUS seismic tomography experiments and centered on the focus of caldera floor uplift during the unrest period of 2011-12.
CSK-18A (Alternate)	36.3755 25.3942	291	380	0	380	CSK-18A is sited in the southern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them, as well as to penetrate below unit S3 (probable intracaldera tuff of the LBA eruption). This site is complementary to sites in the northern caldera basin, as together they will provide a complete understanding of the caldera fill and collapse history.
CSK-19A (Alternate)	36.5563 25.7503	688	730	10	740	CSK-19A is sited in the Anafi Basin. The aim is to penetrate the entire volcano-sedimentary fill of this basin as far as the Alpine basement. The basin potentially records the full volcanic history of Santorini (and any older centres) since rift inception, but not of Kolumbo Volcano. The hole will reconstruct the subsidence and sedimentary history of this basin, to compare with that of the Anhydros Basin. It will transect all six seismic units present in the basin (B1 to B6).

Proposed Sites (Continued; total proposed sites: 19; pri: 6; alt: 13; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
CSK-20A (Alternate)	36.3127 25.1501	515	899	10	909	CSK-20A is sited in the Christiana Basin. This basin is deeper than the Anhydros and Anafi Basins, and is located SW of Santorini. Its volcano-sedimentary fill potentially records the earlier volcanic history of the CSK volcanic field (including the products of Christiana and early Santorini), as well as younger Santorini and possibly Milos Volcano. The hole will pass through alternating volcanic units, including volcaniclastics from Santorini (marine units Th1-3, with three possible pyroclastic flow deposits Pf1-3), and volcaniclastics from Christiana (Ch1, 2), to the pre-volcanic basement.
CSK-21A (Alternate)	36.5068 25.5053	309	730	0	730	CSK-21A lies in the Anhydros Basin on the SE submarine flank of Kolumbo Seamount Volcano. The aim is to penetrate seismically recognized volcanic eruption units from Kolumbo (K1, K3, K5), as well as many units from Santorini. This will enable characterisation of the products of the Kolumbo eruptions, as well as construction of a coherent stratigraphy for Santorini and Kolumbo together.

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Paraskevi	Nomikou	University of Athens	Greece	Other Lead	Marine geology
Steffen	Kutterolf	Geomar	Germany	Other Lead	Marine sedimentology and tephra
Dimitrios	Papanikolaou	University of Athens	Greece	Other Lead	Tectonics
Jan	Behrmann	Geomar	Germany	Other Proponent	Tectonics
Philipp	Brandl	Geomar	Germany	Other Proponent	Petrology and geochemistry
Ralf	Gertisser	University of Keele	United Kingdom	Other Proponent	Petrology and geochemistry
Jörg	Geldmacher	Geomar	Germany	Other Proponent	Geochemistry and geochronology
Emilie	Hooft	University of Oregon	United States	Other Proponent	Marine seismology
Stephanos	Kilias	University of Athens	Greece	Other Proponent	Biomineralization
Martijn	Klaver	University of Bristol	United Kingdom	Other Proponent	Isotope geochemistry
Costas	Papazachos	Aristotle University	Greece	Other Proponent	Seismology
Raphael	Paris	University Clermont Auvergne	France	Other Proponent	Textural analysis
Paraskevi	Polymenakou	HCMR	Greece	Other Proponent	Microbiology
David	Pyle	University of Oxford	United Kingdom	Other Proponent	Volcanology
Christopher	Satow	Oxford Brookes University	United Kingdom	Other Proponent	Marine sedimentology and tephra
Masako	Tominaga	Texas A&M University	United States	Other Proponent	Marine geophysics and magnetometry
Maria	Triantaphyllou	University of Athens	Greece	Other Proponent	Marine micropalaeontology
Aradhna	Tripati	UCLA	United States	Other Proponent	Stable isotope geochemistry

Addendum – IODP proposal 932-ADD

Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece

Science objectives, hypotheses, and strategies

The scientific objectives and strategies of this addendum remain identical to those in 932-FULL. The proponent team also remains unchanged. The revised drill site map is shown in Figure 1.

New site characterisation data

A total of 620 km of new, high-quality, multichannel seismic profiles were successfully shot in October of 2019 on the German ship RV Poseidon (cruise POS538), under the leadership of Dr. Jens Karstens (Figure 2; Table 1). These have enabled us to place all drill sites on cross points and to obtain new profiles for the Christiana Basin. These new profiles are listed in the text and Table 2 as GEOMAR_Pxxxx.

At the request of the SEP, we obtained a cross profile for sites CSK-01A and CSK-02A. The original drill sites for the Christiana Basin (sites CSK-11A and CSK-12A in 932-FULL), proved to be inappropriate since major slumping is clearly visible on our new profiles. Indeed these sites were based on previously published profiles (Tsampouraki-Kraounaki et al. 2018), not our own. We therefore shot a series of profiles in another part of the basin, NW of Christiana Volcano, and found perfect new primary (CSK-13A) and alternate (CSK-14A, CSK-20A) sites in an area of undisturbed stratigraphy (Figure 3).

Re-processing and its effects on the profiles

All used seismic data have been processed at University of Hamburg with Schlumberger's VISTA system. The reprocessing is described fully in the uploaded file "Reprocessing_Report.pdf". All uploaded re-processed SEG-Ys have the extension "-REPROC". The enhanced resolution is illustrated by the data in Figure 4.

Drill sites

Primary drill sites CSK-01A, 03A and 09A are the same as in 932-FULL. Primary sites CSK-05A and CSK-07A have been very slightly moved and renamed CSK-05B and CSK-07B.

The new primary site in the Christiana Basin CSK-13A replaces CSK-11A. It is situated NE of Christiana on seismic profiles that reveal a much more coherent stratigraphy, including units interpreted as derived from Christiana and Santorini (Figure 4).

Alternate sites CSK-02A, CSK-04A and CSK-10A are the same as in 932-FULL. Alternate site CSK-04B has been renamed CSK-21A at the request of the IODP proposal manager. Alternate sites CSK-06A and CSK-08A have been very slightly moved and renamed CSK-06B and CSK-08B. Site CSK-14A is a new alternate to CSK-13A.

At SEP's request, we have also added an additional alternate site for each of the six primary drill sites (new sites CSK-15A to CSK-20A). Our approach has been to choose a site a few hundred metres along seismic profile from the primary site. The justification for this is that the primary sites were chosen as being ideal for the science, and so it is logical to stay reasonably close to these. These 'additional alternate' sites are not all at crossing points, but they lie on at least one seismic profile and near the crossing point of the corresponding primary site.

We have not assigned priorities to the different alternates, since the choice between them would depend on the nature of any problem associated with the primary site.

All sites are in Greek Territorial Waters. Former sites CSK-11A and CSK-12A in the Christiana basin (replaced by CSK-13A and CSK-14A, respectively) have been deleted from the site database.

There follows an explanation of each site, with reference to the classification assigned by SEP in its evaluation of 932-FULL. For brevity, we exclude the extension "REPROC" on the seismic profile names.

Primary sites

CSK-01A (SEP classification 4). This hole will transect and characterize all six seismic packages of the Anhydros rift basin (B1 to B6) to the Alpine basement. The profile HH06-15 has been

reprocessed to enhance resolution and to remove ghost reflection and seafloor multiple. A single 2019 MCS cross line GEOMAR_P2002 is now provided linking sites CSK-01A and CSK-02A.

CSK-03A (SEP classification 2). This site will penetrate four seismically recognized volcanic eruption units from Kolumbo (K2, K3, K5 and the thin lateral continuation of K1), as well as eruption units from Santorini. Profiles HH06-22 and -34 have been reprocessed to better resolve the structure at depth, to enhance resolution, and to remove ghost reflection and seafloor multiple.

CSK-05B. Site CSK-05A (SEP classifications 2) has now been replaced by site CSK-05B. This site lies in the northern basin of Santorini caldera and will penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them and confirm (or not) published hypotheses. It will also penetrate below unit S3 (probably intracaldera tuff of the LBA eruption). Sparker profile HH15-SP1 that linked CSK-05A with CSK-06A has been replaced by new 2019 profile GEOMAR_P1006. Cross-profile (Sparker-source) HH15-SP5 has been replaced by new 2019 profile GEOMAR_P3004.

CSK-07B. Site CSK-07A (SEP classifications 2) has now been replaced by site CSK-07B. This site lies in the southern basin of Santorini caldera. It will penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them, as well as penetrate below unit S3 (probable intracaldera tuff of the Late Bronze Age eruption). It is complementary to site CSK-05B in the northern caldera basin, as together they will provide a complete understanding of the caldera fill and collapse history. Sparker profile HH15-SP10 that links CSK-07A with CSK-08A has been replaced by new 2019 profile GEOMAR_P1006. Cross-profiles 20060504_052810 and 20060504_044615 have been reprocessed for ghost and bubble suppression and migration.

CSK-09A (SEP classification 1). This site will transect all six seismic units present in the Anafi basin (B1 to B6) to the Alpine basement. It remains unchanged from 932-FULL, but the reprocessed data (profiles HH06-09-REPROC, HH06-09-15-REPROC) elucidate strata much better.

CSK-13A. This is our new primary site for the Christiana Basin (replaces CSK-11A in FULL). The aim of drilling in the Christiana Basin remains to allow us to access an earlier volcanic history than the basins to the north-east of Santorini. The new primary site is situated NE of Christiana on seismic profiles that reveal a much more coherent stratigraphy, including units interpreted as derived from Christiana (Ch1 and Ch2) and Santorini (Th1, Th2, and Th3) (Figure 3). Three prominent reflectors (Pf1, Pf2 and Pf3) are tentatively interpreted as pyroclastic flow deposits from Santorini. These new profiles in the Christiana Basin are greatly superior in quality to those presented in 932-FULL. We note that our new seismic lines provide an excellent basis, along with drill cores, for unravelling the stratigraphy of these volcanoes, since the resolution is much better than before. In particular, the newly acquired seismic data from Christiana Basin allow for distinguishing those pyroclastic flows and sediments that origin from Santorini from those that origin from Christiana. With a single drill site, we can unravel the correlations between Christiana and Santorini by drilling down to the pre-volcanic basement. We also anticipate the presence of volcaniclastics derived from Milos volcano (NW of Santorini) in this core. The site is crossed by profiles GEOMAR_P5009 and GEOMAR_P5006.

Alternate sites

CSK-02A (SEP classification 4). This is an alternate for CSK-01A. The profile HH06-14 has been reprocessed to enhance resolution and to remove ghost reflection and seafloor multiple. A single 2019 MCS cross line GEOMAR_P2002 is now provided linking sites CSK-02A and CSK-01A.

CSK-04A (SEP classification 2). This is an alternate to CSK-03A. While it appears that this hole does not encounter the different eruptive units from Kolumbo, we anticipate that this is simply an artefact of image resolution. Inspection suggests that these units should extend to this site, but are too thin to show at this scale. We keep this site in case sites CSK-03A, 16A and 21A (which are located closer to Kolumbo vent) encounter very coarse ejecta. Reprocessing of lines HH06-22 and HH06-44 resolves the strata now sufficiently.

CSK-06B. Site CSK-06A (SEP classifications 2) has now been replaced by site CSK-06B. It is an alternate for 05B. Sparker profile HH15-SP1 that links CSK-05A with CSK-06A has been replaced by new 2019 profile GEOMAR_P1006. Cross-profiles (Sparker-source) HH15-SP6 has been replaced by new 2019 profile GEOMAR_P3003.

CSK-08B. Site CSK-08A (SEP classifications 3) has now been replaced by site CSK-08B. It is an alternate for CSK-07B. Sparker profile HH15-SP10 that links CSK-07A with CSK-08A has been replaced by new 2019 profile GEOMAR_P1006. Cross-profiles 20060504_052810 and 20060504_044615 have been reprocessed for ghost and bubble suppression and migration.

CSK-10A (SEP classification 1). This site is an alternate for CSK-09A. It remains unchanged from 932-FULL, but the reprocessed data (profiles HH06-04-REPROC, HH06-15-REPROC) elucidate strata much better.

CSK-14A. This is an alternate to site CSK-13A and is located at a crossing of GEOMAR_P5009 and 20060506_214929.

CSK-15A. This is an additional alternate site to CSK-01A, shifted 675 m towards the basin center and master fault along profile HH06-15-REPROC. No crossing line is present.

CSK-16A. This is an additional alternate site to CSK-03A, shifted along profile HH06-22-REPROC 1350 m closer to Kolumbo caldera. Here, the volcanic sequences are thicker. No crossing line is present.

CSK-17A. This is an additional alternate site to CSK-05B, shifted along GEOMAR_P1006 220 m closer to the basin center. No crossing line is present.

CSK-18A. This is an additional alternate site to CSK-07B in the southern Santorini caldera, constrained by profiles GEOMAR_P1006 and 20060429_13414.

CSK-19A. This additional alternate site to CSK-09A is directly in the basin center, constrained by near-by crossing lines.

CSK-20A. This is an alternative Site to CSK-13A and is located a crossing of GEOMAR_P5009 and GEOMAR_P5008.

CSK-21A. Site CSK-04B (SEP classifications 3) has been renamed CSK-21A at the request of the IODP proposal manager. It is an alternate to CSK-03A. By drilling deep below unit K1, this hole offers an opportunity to sample early products of Kolumbo not yet identified seismically. After the reprocessing the profiles HH06-37 and HH06-45 nicely resolve the deeper strata.

Modified coring and logging operations

The revised drilling operations plan is as follows. Primary drill sites outside the caldera will each need 10 to 12 operational days, including 1-2 days of logging and 8 to 11 days of drilling. Drilling inside the caldera will NOT require casing and we expect ~4 days of drilling at both sites followed by 1 day of logging. Operational days on primary sites sum to ~55 days, and the total expedition duration (including ~1 days of transit time and 5 days port call) amounts to ~61 days for a drilling sequence CSK-09, CSK-01, CSK-03, CSK-13, CSK-05, CSK-07.

Survey (Year)	No. of Profiles	Length	Source	Channels	Streamer length	Dominant frequency	Data holder
2006_A	51	1500 km	1 GI-Gun (45/105 cin)	24	600 m / 150 m	100 Hz	UHH
2006_B	128	990 km	1 airgun (10 cin)	1	SCS	60 Hz	UA
2012_A	19	82 km	1 airgun (10 cin)	1	SCS	125 Hz	UA
2012_B	13	38 km	1 airgun (10 cin)	1	SCS	125 Hz	UA
2015	13	120 km	1 Sparker (6 KJ)	24	100 m	300 Hz	UHH
2019	44	620 km	1 GI-Gun (75/75 cin)	132/ 120 / 32	200 m / 187.5 m /50 m	150 Hz	GEOMAR

Table 1. Summary of seismic acquisition, including the 2019 cruise. Abbreviations: cin: Cubic inch (volume); SCS: Single channel seismics; UA: University of Athens; UHH: University of Hamburg.

Site	Primary or Alternate	Coordinates	line 1 CDP	Line 2 CDP	Water Depth (m)	Penetration (m)
01A	P	36.7293°N 25.6482°E	HH06-15-REPROC CDP 2746	GEOMAR_P2002 CDP 5572	489	765
02A	A	36.7438°N 25.7146°E	HH06-14-REPROC CDP 150	GEOMAR_P2002 CDP 1636	488	447
03A	P	36.5549°N 25.4398°E	HH06-34-REPROC CDP 760	HH06-22-REPROC CDP 614	397	566
04A	A	36.5728°N 25.4092°E	HH06-44-REPROC CDP 1626	HH06-22-REPROC CDP 345	402	545
05B	P	36.4356°N 25.3806°E	GEOMAR_P1006 CDP 20079	GEOMAR_P3004 CDP 1259	385	360
06B	A	36.4423°N 25.3752°E	GEOMAR_P1006 CDP 20648	GEOMAR_P3003 CDP 2159	383	360
07B	P	36.38895°N 25.41713°E	GEOMAR_P1006 CDP 15324	20060504_052810-REPROC CDP 234	292	360
08B	A	36.38161°N 25.40606°E	GEOMAR_P1006 CDP 14501	20060504_044615-REPROC CDP 801	293	375
09A	P	36.5656°N 25.7613°E	HH06-15-REPROC CDP 1067	HH06-09-REPROC CDP 3403	694	595
10A	A	36.5494°N 25.7714°E	HH06-15-REPROC CDP 906	HH06-04-REPROC CDP 1755	672	377
13A	P	36.3243°N 25.1826°E	GEOMAR_P5009 CDP 5042	GEOMAR_P5006 CDP 4431	489	857
14A	A	36.3049°N 25.1286°E	GEOMAR_P5009 CDP 1644	20060506_214929-REPROC CDP 886	523	756
15A	A	36.7320°N 25.6463°E	HH06-15-REPROC CDP 2770	Does not apply	490	800
16A	A	36.5480°N 25.4517°E	HH06-22-REPROC CDP 722	Does not apply	372	565
17A	A	36.4339°N 25.3819°E	GEOMAR_P1006 CDP 19938	Does not apply	386	420
18A	A	36.3755°N 25.3942°E	GEOMAR P1006 CDP 13690	20060429_134104-REPROC CDP 1845	291	380
19A	A	36.5563°N 25.7503°E	HH06-04-REPROC CDP 1919	300 m N of cross-line GEOMAR_P5017	688	740
20A	A	36.3127°N 25.1501°E	GEOMAR_P5009 CDP 3013	GEOMAR_P5008 CDP4521	515	909
21A	A	36.5068°N 25.5053°E	HH06-37-REPROC CDP 1009	HH06-45-REPROC CDP 5727	309	730

Table 2. Summary of the proposed drilling sites.

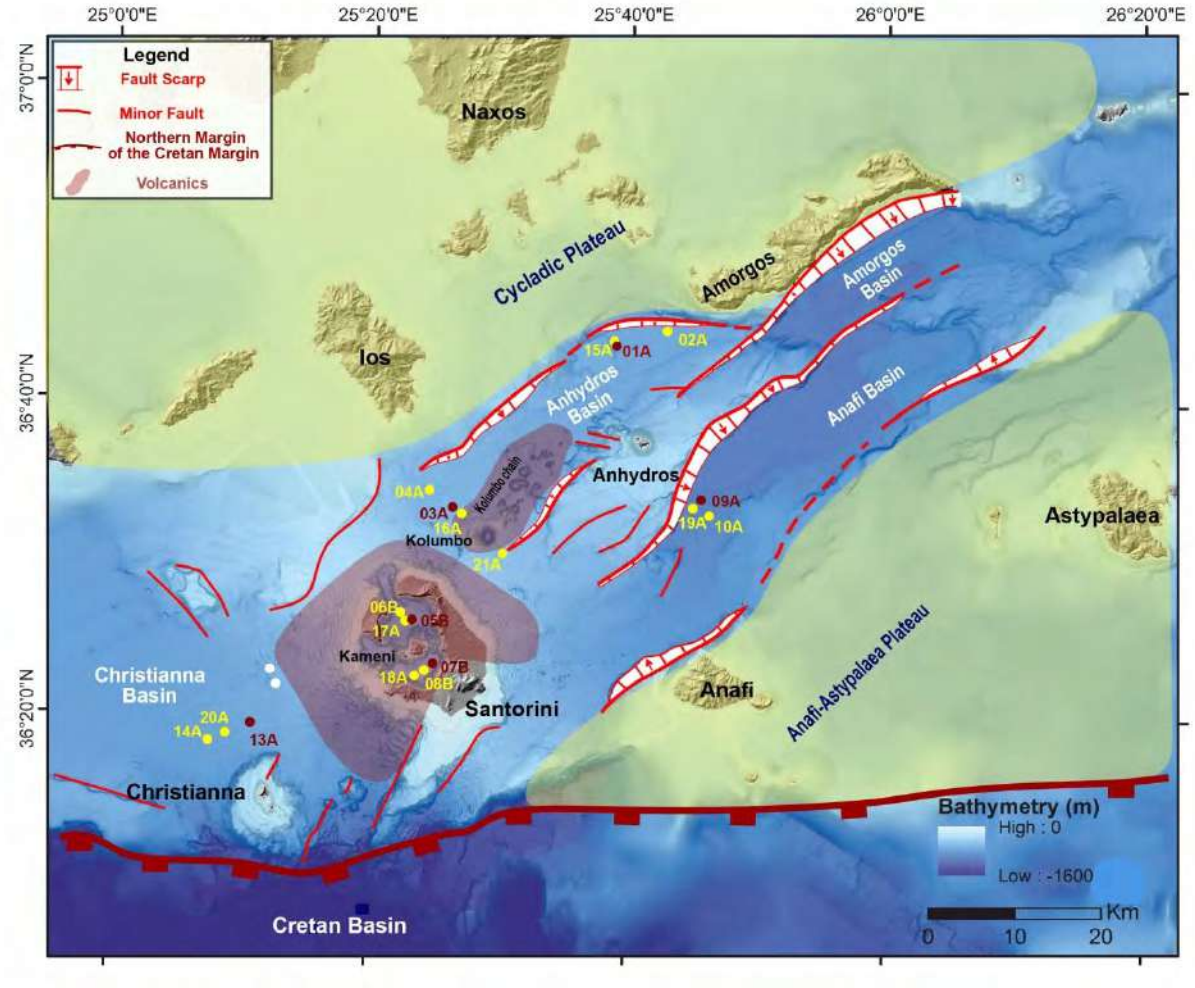


Figure 1. Locations of the drilling sites from 932-ADD (red dots, primary sites; yellow dots, alternate sites). The two sites shown as white dots are sites 11A and 12A of 932-FULL, which have now been removed for reasons explained in the text. Site 21A is the same as 04B in FULL, renamed following a request from the IODP proposal manager.

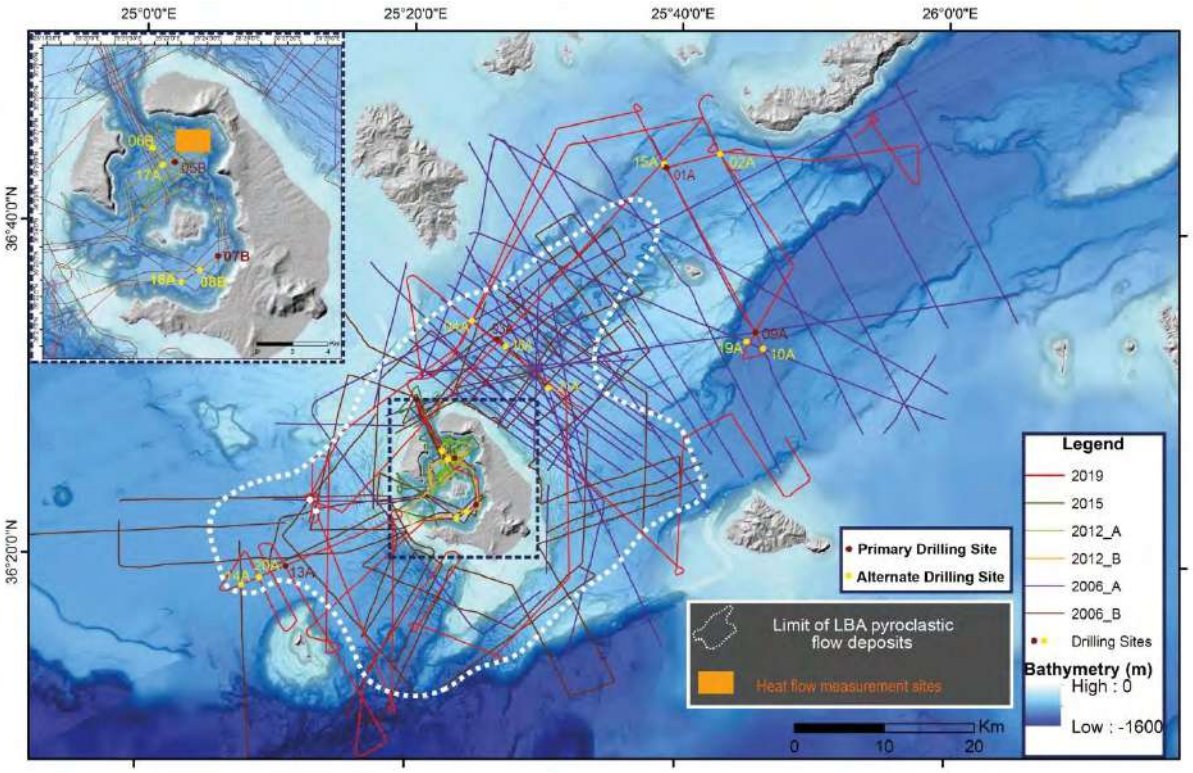


Figure 2. Available seismic lines in and around the Christiana-Santorini-Kolumbo (CSK) volcanic field, with those around and inside of Santorini caldera shown enlarged in the inset. Lines from 2006 to 2015 were presented in 932-FULL. In October 2019, in response to the SEP evaluation, we shot the additional multi-channel lines shown in red. The proposed drilling sites are taken from Figure 1. The two sites shown as white dots are sites 11A and 12A of 932-FULL, which have now been disactivated for reasons explained in the text. The submarine limit of pyroclastic flows from the Late Bronze Age eruption of Santorini are also shown, as are heat flow measurement sites (from Hannington et al. 2017) that were already presented in 932-FULL.

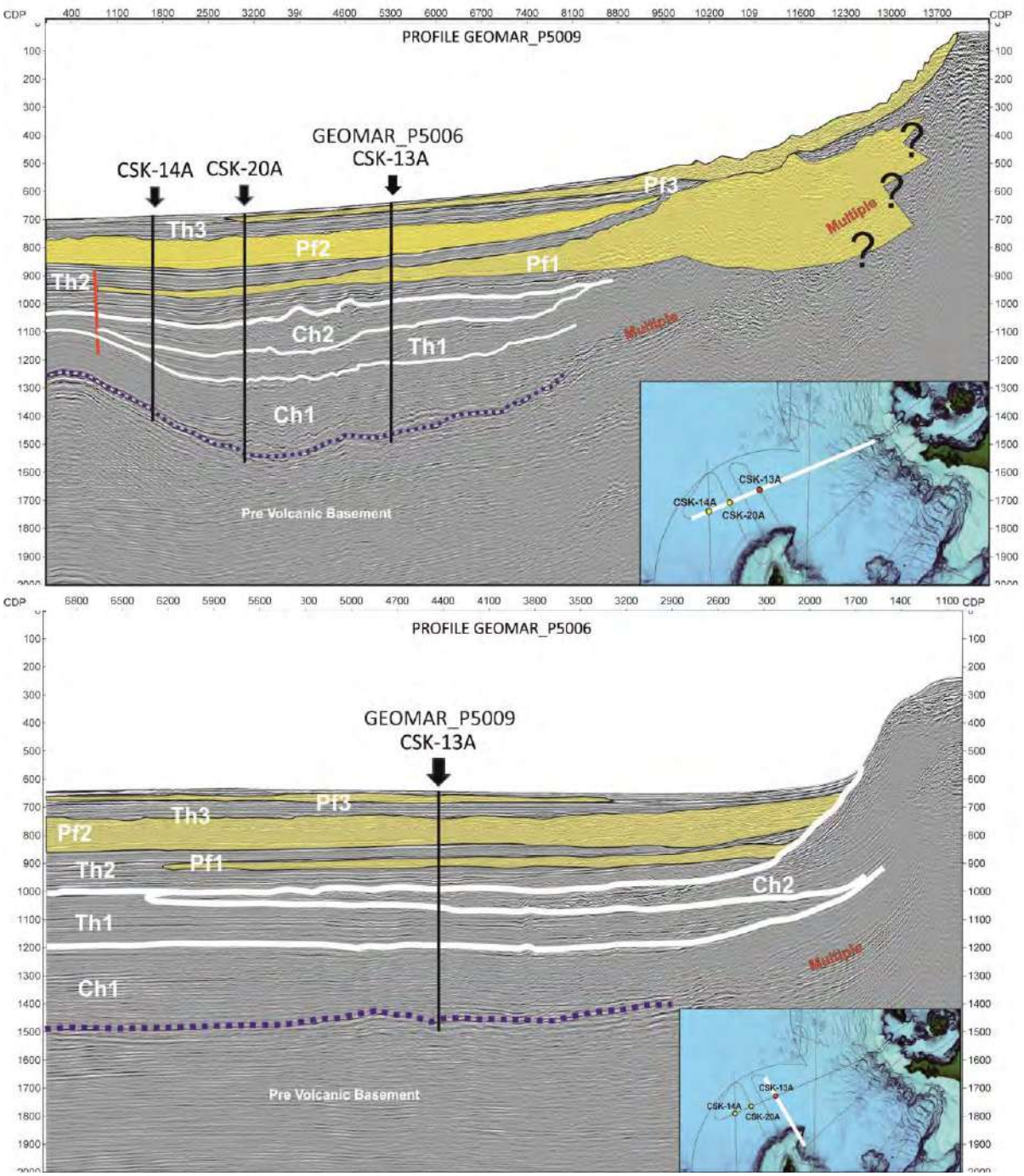


Figure 3. New (2019), multi-channel seismic profiles in the Christiana Basin, showing new primary site CSK-13A (and nearby alternate sites CSK-14A and CSK-20A). This primary site replaces site 11A in 932-FULL, since new seismic profiles of site 11A revealed major slumping (site 11A and its alternate 12A have now been removed from the proposal). Site 13A will penetrate the volcano-sedimentary fill of the Christiana basin to the pre-volcanic basement, traversing units interpreted as derived from Christiana (Ch1 and Ch2) and Santorini (Th1, Th2, and Th3). Three prominent reflectors (Pf1, Pf2 and Pf3) are tentatively interpreted as pyroclastic flow deposits from Santorini. Drilling in the Christiana Basin should allow us to access an earlier volcanic history than the basins north-east of Santorini. The quality of these new profiles in the Christiana Basin is greatly superior to those presented in 932-FULL. The red line is a fault and the black vertical lines show proposed penetration to the pre-volcanic basement.

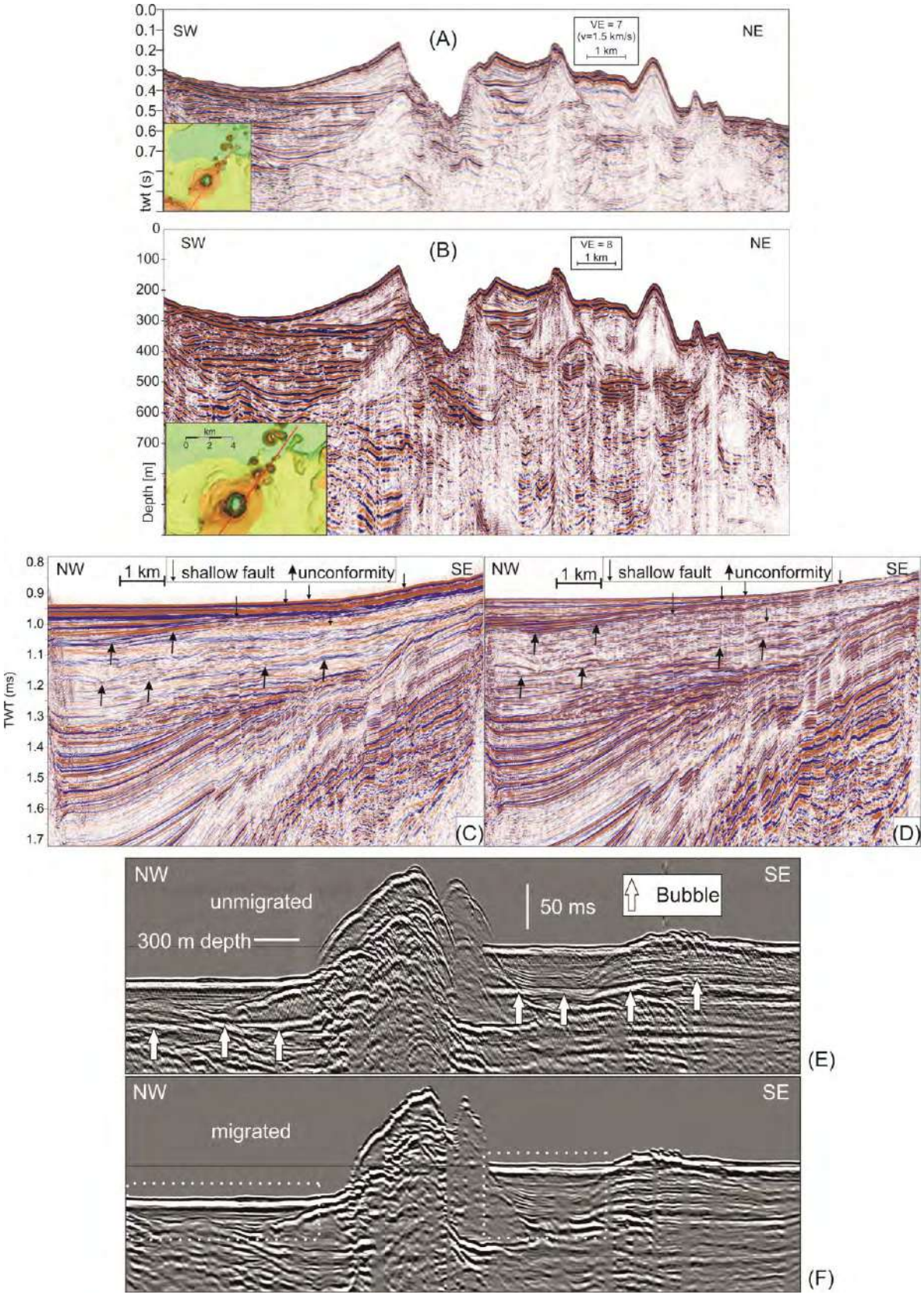


Figure 4. Reprocessing instances. Brutstacks are A, C and E, the reprocessed profiles are shown in B, D and F. A and B show a profile across Kolumbo submarine volcano. Depth conversion in (D) by depth stretching. Profile C/D crosses the Amorgos Basin. Note the shallow faults and internal reflection configuration. E/F is an instance if the 2006 single channel seismics from Santorini caldera.

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-01A targets the plio-quaternay volcano-sedimentary fill of the Anhydros Basin, to the depth of the Alpine basement. The site lies near the basin axis in a position downstream of Santorini and Kolumbo Volcanoes. The aim is to use the core (and seismic profiles) to reconstruct the volcanic, sedimentary and tectonic histories of the basin, and to access a near-continuous time series of volcanism in the area since rift inception. The hole will transect and characterize all six seismic packages of the Anhydros rift basin (B1 to B6).
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-01A	Area or Location:	Anhydros Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#			
Latitude:	Deg: 36.7293	Jurisdiction:	Greek territorial waters
Longitude:	Deg: 25.6482	Distance to Land: (km)	10
Coordinate System:	WGS 84		
Priority of Site:	Primary: ✓ Alternate: ☐	Water Depth (m):	489

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	756	9
Total Sediment Thickness (m)	756	
Total Penetration (m):	765	

General Lithologies:	Muds, volcaniclastics, debris flows, turbidites / Limestone, schist or granite
Coring Plan: (Specify or check)	2 Holes APC/HLAPC to refusal, each followed by XCB to 610 mbsf; drill ahead in Hole C to 575 mbsf with the option of one or two cored intervals of 50 meters in between and afterwards RCB to 765 mbsf, including 9 m of basement or until refusal; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days:	Drilling/Coring: 10.7	Logging: 1.6	Total On-site: 12.3

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-01A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: HH06-15-REPROC Position: CDP 2746
1b High resolution seismic seismic reflection (crossing)	yes	Line: GEOMAR_P2002 Position: CDP 5572
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	yes	See Velocity_Table.pdf
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	yes	The 3.5 kHz profiles do not run along the site survey profiles, but image the shallow strata on a regional scale.
7 Swath bathymetry	yes	CSK-Bathymetry.grd, CSK-Bathymetry.pdf
8a Side looking sonar (surface)	yes	
8b Side looking sonar (bottom)	no	
9 Photography or video		
10 Heat Flow		
11a Magnetics	yes	CSK-Mag.grd, CSL-Mag.pdf These grids cover entire study area on a regional scale, covering all sites. There are no site specific grids or maps.
11b Gravity	yes	CSK-Gravity-FreeAir.grd, CSK-Gravity-FreeAir.pdf CSK-Bouguer.grd, CSK-Gravity-FreeAir.pdf These grids cover entire study area on a regional scale, covering all sites. There are no site specific grids or maps.
12 Sediment cores	yes	~5m long gravity core and a box corer (POS513/15 and 21), 7 km from site position showing soft hemipelagic muds with some 1 to 5 cm thick intercalated ash layers; Sedimentation rate ~9 cm/ka.
13 Rock sampling		
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	HH06-15-REPROC.txt, GEOMAR_P2002.txt
17 Other	no	

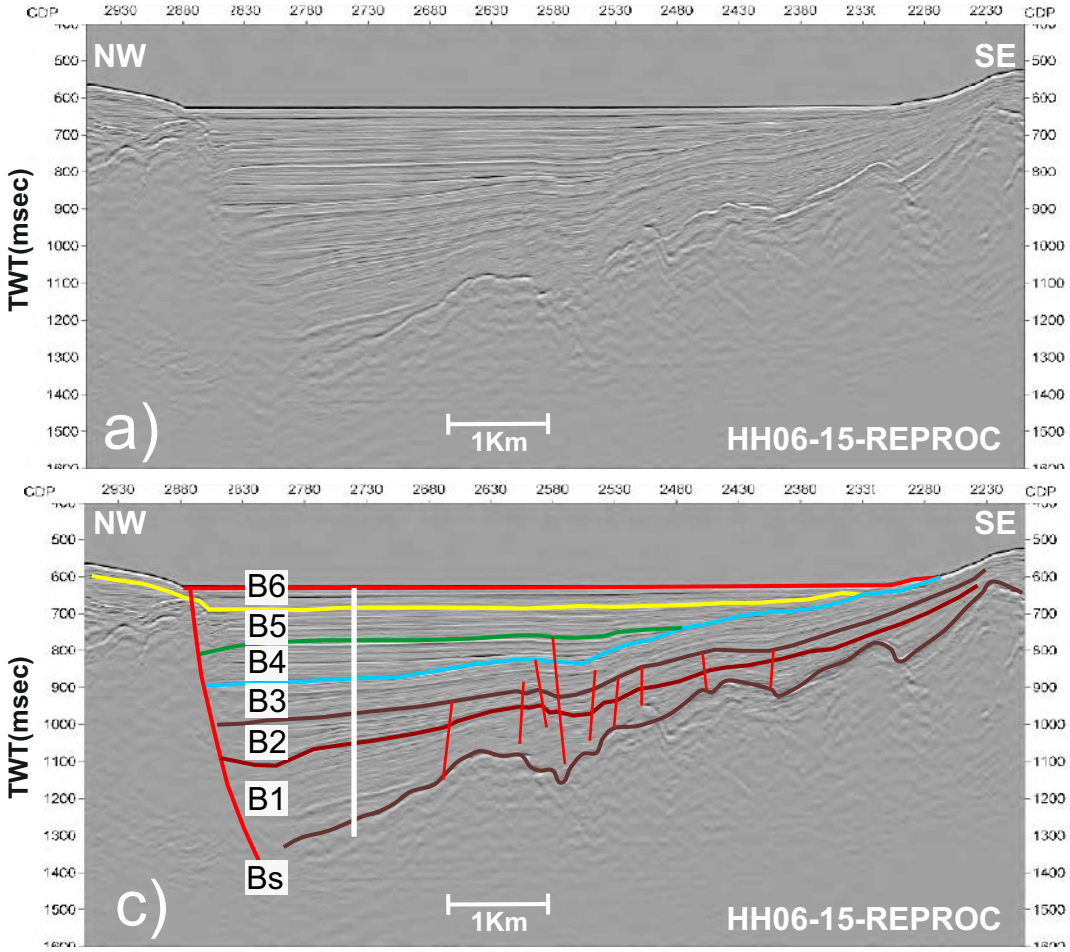
Proposal #: 932 - Add	Site #: CSK-01A	Date Form Submitted: 2019-11-22 13:07:02

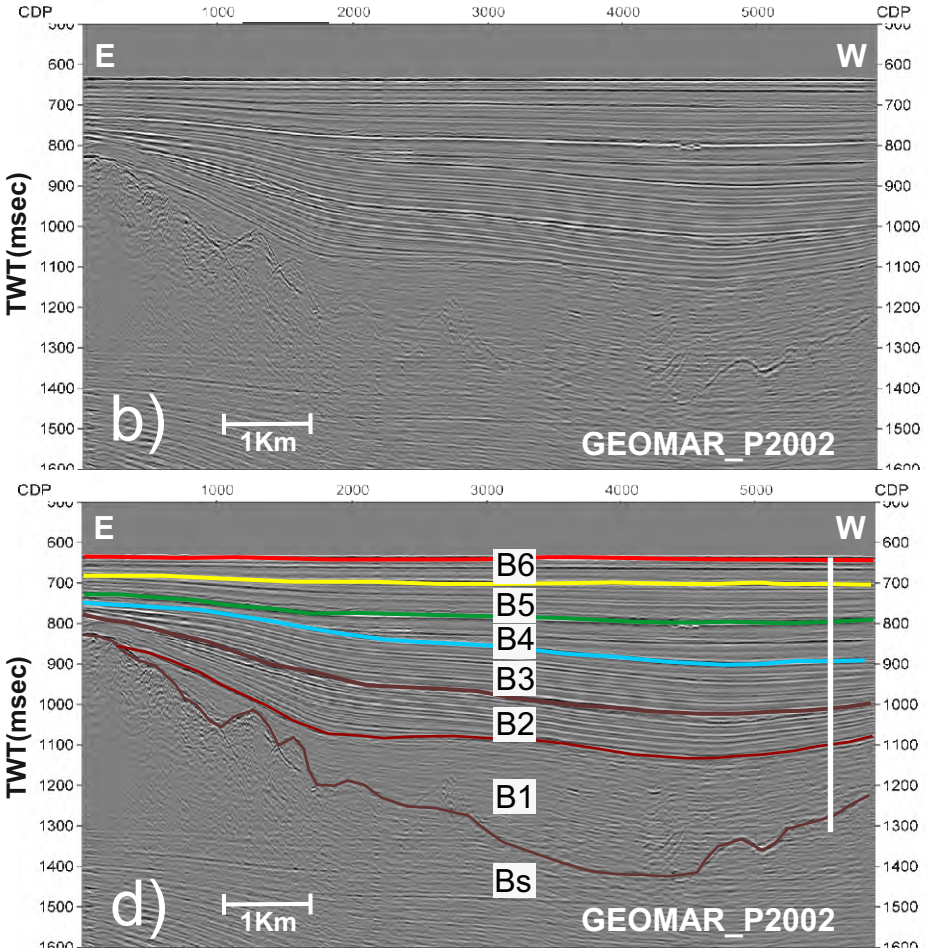
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to 610 mbsf; Hole C: RCB drilling ahead until 575 mbsf with the option of one or two cored intervals of 50 meters in between, RCB to 765 mbsf including 9 m of basement, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	no
5. Are there reasons to expect hydrocarbon accumulations at this site?	no
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	Non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	Target drill depth may be to deep for XCB only

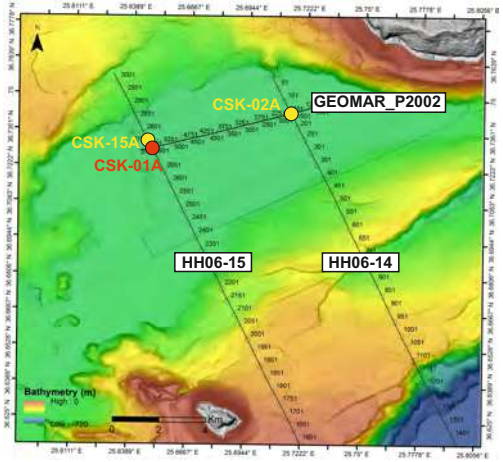
Proposal #: 932 - Add	Site #: CSK-01A	Date Form Submitted: 2019-11-22 13:07:02

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 43	Seismic unit B6: horizontal dipping beds, one stronger reflector at ~20 m	Pleistocene/ Holocene	1.6	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	180	lithology similar like in gravity core; interpretation Nomikou et al. (2016b; 2018)
43 - 95	Seismic unit B5: horizontal dipping beds	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	170	lithology and structures are the same like in first seismic units but stronger compacted; Interpretation after Nomikou et al. (2016b; 2018)
95 - 239	Seismic unit B4: horizontal dipping beds, several stronger reflectors distributed within the unit	Early? Pleistocene	2.0	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	160	More turbiditic deposits but at drill site still horizontal layering; interpretation after Nomikou et al. (2016b; 2018)
239 - 349	Seismic unit B3: subhorizontal dipping beds, several stronger reflectors distributed within the unit	Early Pleistocene/ Pliocene	2.1	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	150	Inclination in bedding indicate either initial fill off the rifted basin or tectonic activity; interpretation after Nomikou et al. (2016b; 2018)
349 - 488	Seismic unit B2: subhorizontal dipping beds, several stronger reflectors distributed within the unit; chaotic layering in the lower part?	early Pleistocene?/ Pliocene	2.4	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift	120	Inclination in bedding indicate either initial fill off the rifted basin or tectonic activity; chaotic layer may indicate slumping and mass flows; interpretation after Nomikou et al. (2016b; 2018)
488 - 756	Seismic unit B1: subhorizontal dipping beds on basement unconformity	Pliocene	2.6	MTD´s, sands and gravel, turbidites, hemipelagic muds, volcaniclastics	submarine to continental; initial filling of a rift basin	110	initial filling sequence of the rift with mixed volcaniclastic and continental material; interpretation after Nomikou et al. (2016b; 2018)
756 - 765	continental basement	Mesozoic	3.0	limestone, schists, granites	continental basement	??	Interpretation after Nomikou et al. (2016b; 2018)

CSK-01A







CSK-01A: HH06-15-REPROC, CDP 2746 (a and c); GEOMAR_P2002, CDP 5572 (b and d)
Files to be uploaded to SSDB:
Location map: CSK-01A_location.pdf
SEGY-data: HH06-15-REPROC.sgy, GEOMAR_P2002.sgy
Navigation data: HH06-15-REPROC.txt, GEOMAR_P2002.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf

Site Information:
Coordinates: 36.7293/25.6482
Water depth: 489 m
Penetration: 765 m

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-02A targets the plio-quaternay volcano-sedimentary fill of the Anhydros Basin, to the depth of the Alpine basement. The site lies near the basin axis in a position downstream of Santorini and Kolumbo Volcanoes. The aim is to use the core (and seismic profiles) to reconstruct the volcanic, sedimentary and tectonic histories of the basin, and to access a near-continuous time series of volcanism in the area since rift inception. The hole will transect and characterize all six seismic packages of the Anhydros rift basin (B1 to B6).
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-02A	Area or Location:	Anhydros Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.7438	Distance to Land: (km)	6
Longitude:	Deg: 25.7146		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ☑	Water Depth (m):	488

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	437	10
Total Sediment Thickness (m)	437	
Total Penetration (m):	447	

General Lithologies:	Muds, volcaniclastics, debris flows, turbidites	Limestone, schist or granite

Coring Plan: (Specify or check)

3 Holes APC/HLAPC to refusal, each followed by XCB to 447 mbsf including 10 meters into basement or until refusal; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☐ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days:	Drilling/Coring:	Logging:	Total On-site:
	7.1	1	8.1

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window	Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐		
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐		
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐		
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐		
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐		
CO_2	☐						

Sensitive marine habitat (e.g., reefs, vents)

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-02A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: HH06-14-REPROC Position: CDP 150
1b High resolution seismic seismic reflection (crossing)	yes	Line: GEOMAR_P2002 Position: CDP 1636
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	~5m long gravity core and a box corer (POS513/15 and 21), 4 km from site position showing soft hemipelagic muds with some 1 to 5 cm thick intercalated ash layers; Sedimentation rate ~9 cm/ka.
13 Rock sampling		
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	HH06-16-REPROC.txt, GEOMAR_P2002.txt
17 Other	no	

IODP Site Forms

Form 4 - Environmental Protection

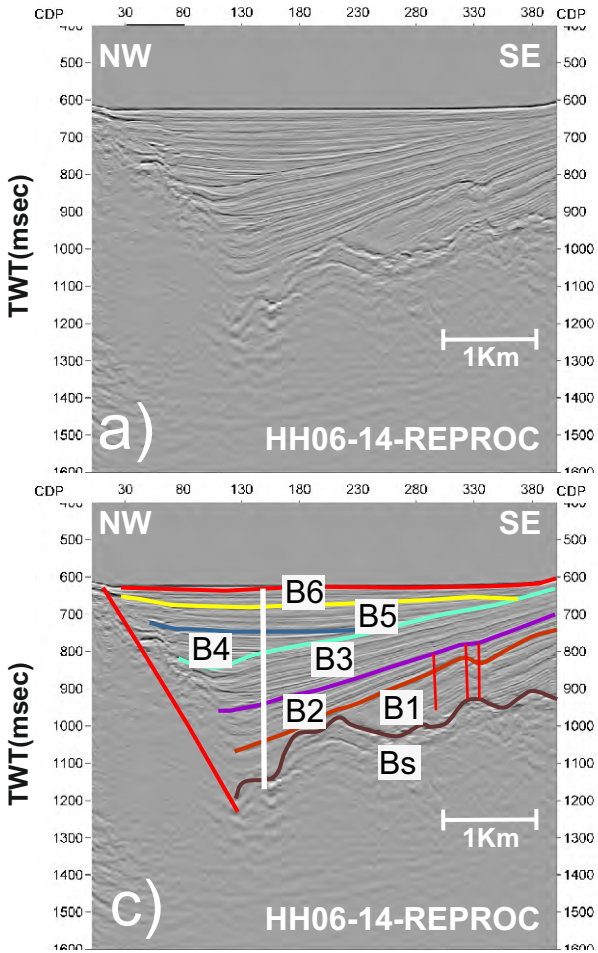
Proposal #: 932 - Add	Site #: CSK-02A	Date Form Submitted: 2019-11-22 13:07:02

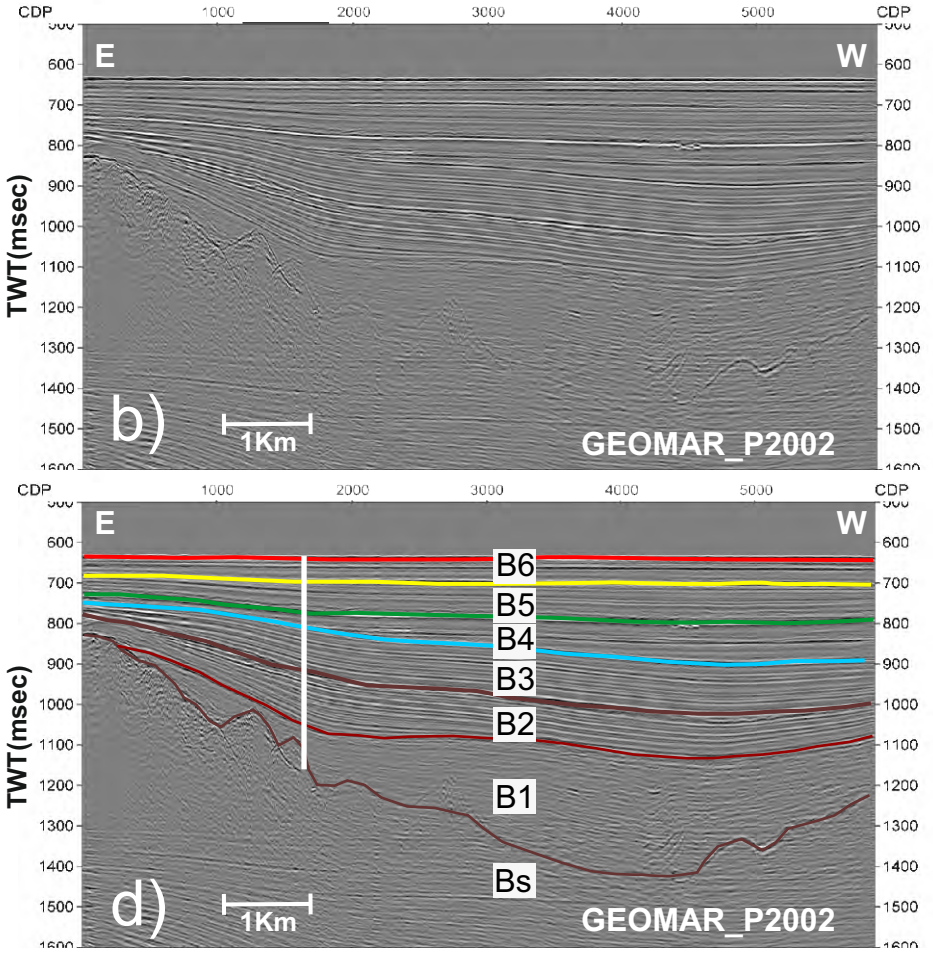
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Tripple APC/HLAPC (Holes A, B, C) to refusal including 4 temperature measurements, each followed by XCB to 447 mbsf including 10 meters of basement or until refusal, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	Target drill depth may be to deep for XCB only

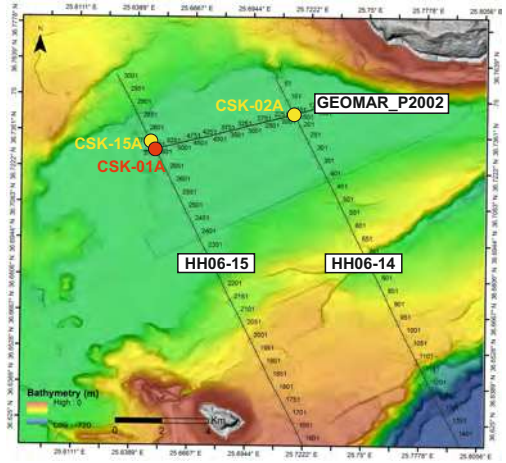
Proposal #: 932 - Add	Site #: CSK-02A	Date Form Submitted: 2019-11-22 13:07:02

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 51	Seismic unit B6: horizontal dipping beds, one stronger reflector at ~30 m	Pleistocene/ Holocene	1.6	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	120	lithology similar like in gravity core; interpretation after Nomikou et al. (2016b; 2018)
51 - 116	Seismic unit B5: horizontal dipping beds	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift	110	lithology and structures are the same like in first seismic units but stronger compacted; interpretation after Nomikou et al. (2016b; 2018)
116 - 152	seismic unit B4 with horizontal dipping beds, several stronger reflectors distributed within the unit	Early? Pleistocene	2.0	hemipelagic muds, volcaniclstics, turbidites	filled submarine rift-basin	100	More turbiditic deposits but at drill site still horizontal layering; interpretation after Nomikou et al. (2016b; 2018)
152 - 291	seismic unit B3 with subhorizontal dipping beds, several stronger reflectors distributed within the unit	Early Pleistocene/ Pliocene	2.1	hemipelagic muds, volcaniclstics, turbidites	filled submarine rift-basin	90	Inclination in bedding indicate either initial fill off the rifted basin or tectonic activity; interpretation after Nomikou et al. (2016b; 2018)
291 - 375	seismic unit B2	Early Pleistocene?/ Pliocene	2.4	hemipelagic muds, volcaniclastics	filled submarine rift-basin	80	Interpretation after Nomikou et al. (2016b; 2018)
375 - 437	Seismic unit B1	Pliocene	2.6	hemipelagic muds, volcaniclastics	submarine to continental; initial filling of a rift basin	70	Interpretation after Nomikou et al. (2016b; 2018)
437 - 447	continental basement	Mesozoic	3.0	Limestones, schists, granites	Basement	??	Interpretation after Nomikou et al. (2016b; 2018)

CSK-02A







CSK-02A: HH06-14-REPROC, CDP 150 (a and c); GEOMAR_P2002, CDP 1636 (b and d)
Files to be uploaded to SSDB:
Location map: CSK-01A_location.pdf
SEGY-data: HH06-14-REPROC.sgy, GEOMAR_P2002.sgy
Navigation data: HH06-14-REPROC.txt, GEOMAR_P2002.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf

Site Information:
Coordinates: 36.7438/25.7146
Water depth: 488 m
Penetration: 447 m

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-03A lies in the Anhydros Basin on the NW submarine flank of Kolumbo Volcano. The aim is to penetrate four seismically recognized volcanic eruption units from Kolumbo (K2, K3, K5 and the thin lateral continuation of K1), as well as many eruption units from Santorini. This will enable characterisation of the products of the Kolumbo eruptions, as well as construction of a coherent stratigraphy for Santorini and Kolumbo together. The site is placed sufficiently away from Kolumbo vent in order to avoid possible coarse, bouldery facies of the eruption units.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-03A	Area or Location:	Anhydros Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.5549	Distance to Land: (km)	9
Longitude:	Deg: 25.4398		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ✓ Alternate: ☐	Water Depth (m):	397

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	566	0
Total Sediment Thickness (m)	566	
Total Penetration (m):	566	

General Lithologies: Muds, volcaniclastics, debris flows, turbidites

Coring Plan: (Specify or check): 3 Holes APC/HLAPC to refusal, each followed by XCB to 566 mbsf; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☐ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 8.2 | Logging: 1.3 | Total On-site: 9.5

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping

Proposal #: 932 - Add	Site #: CSK-03A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: HH06-22-REPROC Position: CDP 614
1b High resolution seismic seismic reflection (crossing)	yes	Line: HH06-34-REPROC Position: CDP 760
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)		Data and info see Site CSK-01A
8b Side looking sonar (bottom)		
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	3 potential gravity cores nearby: POS513/57 1.6 km away showing 20 cm of muddy surface sediments and stuck in >30 cm fine to coarse ash volcaniclastics (63µ to 1 cm grain sizes); POS513/17 in 4 km distance showing 30 cm of muddy surface sediments and stuck in >50 cm fine grained volcaniclastics (<0.5 cm grain sizes); POS513/16 showing 20 cm of muddy surface sediments and stuck in 80 cm fine-grained volcaniclastics (<1mm grain size); Sedimentation rate ~9 cm/ka in muddy sediments, and event sedimentation for volcaniclastics.
13 Rock sampling		
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	HH06-22-REPROC.txt, HH06-34-REPROC.txt
17 Other	no	

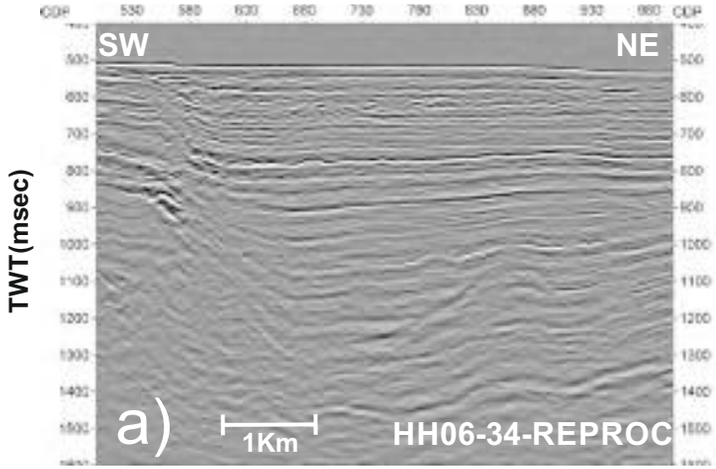
Proposal #: 932 - Add	Site #: CSK-03A	Date Form Submitted: 2019-11-22 13:07:02

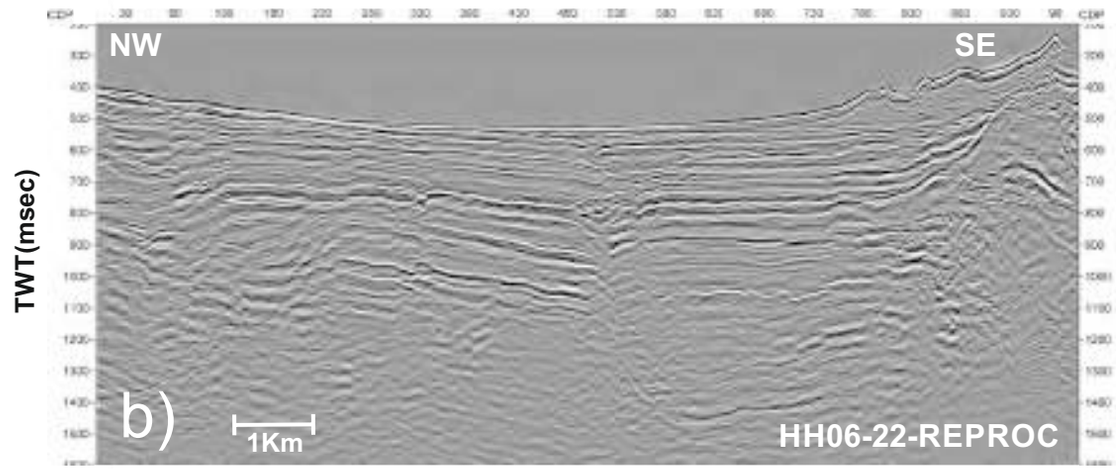
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Tripple APC/HLAPC (Holes A, B, C) to refusal including 4 temperature measurements, each followed by XCB to 566 mbsf, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	Target drill depth may be to deep for XCB only and fine to coarse volcaniclastic in the top 10 meters may be be difficult to penetrate

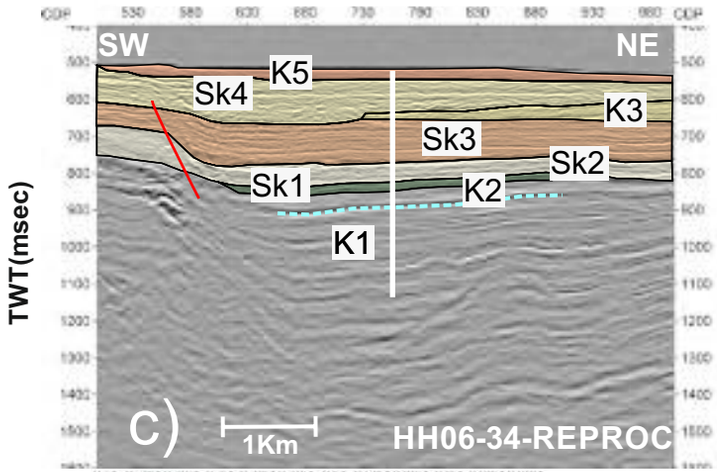
Proposal #: 932 - Add	Site #: CSK-03A	Date Form Submitted: 2019-11-22 13:07:02

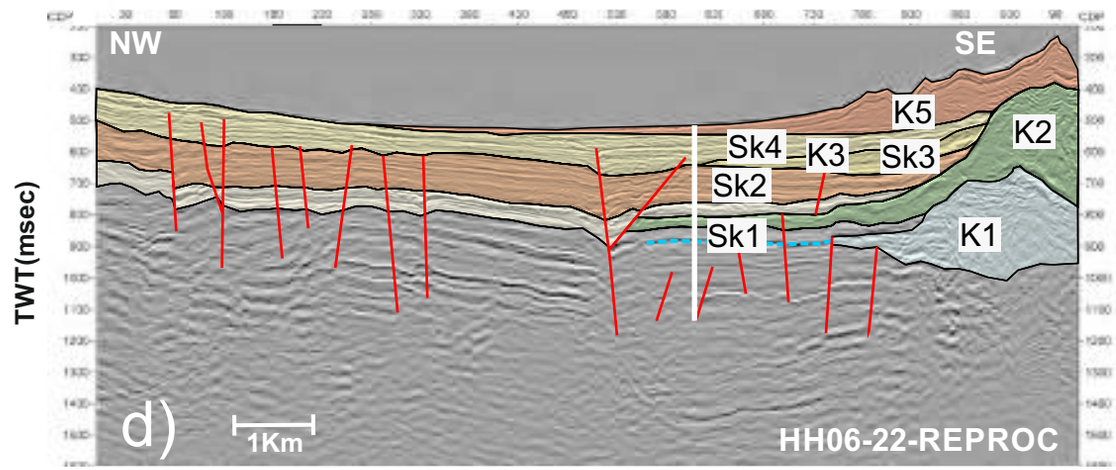
Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 20	Seismic unit K5: AD 1650 eruption of Kolumbo	AD 1650	1.65	Volcaniclastics (pumiceous)	filled submarine rift-basin	>1,000,000	Interpretation of Hubscher et al. (2015)
20 - 118	Seismic unit SK4; Volcaniclastics (including debris flows) from Santorini, and marine sedimentation	Holocene/ Upper Pleistocene	1.7	hemipelagic muds, volcaniclastics, turbidites, MTD´s	filled submarine rift-basin	130	Interpretation of Hubscher et al. (2015)
118 - 129	Seismic unit K3: eruption of Kolumbo	Pleistocene	1.75	volcaniclastics (probably pumiceous)	filled submarine rift-basin	>1,000,000	Interpretation of Hubscher et al. (2015)
129 - 212	Seismic unit SK3: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	120	Interpretation of Hubscher et al. (2015)
212 - 266	Seismic unit SK2: Volcaniclastics from Santorini (incuding mass flows) and marine sedimentation	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	110	Interpretation of Hubscher et al. (2015)
266 - 288	Seismic unit K2: eruption of Kolumbo	Pleistocene	1.85	volcaniclastics (probably pumiceous)	filled submarine rift-basin	>1,000,000	Interpretation of Hubscher et al. (2015)
288 - 311	Seismic unit SK1: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene	1.9	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	100	Interpretation of Hubscher et al. (2015)
311 - 320	Seismic unit K1: eruption of Kolumbo (intercalated within SK1)	Pleistocene	1.95	Volcaniclastics (probably pumiceous)	filled submarine rift-basin	>1,000,000	Presence of unit K1 extrapolated on seismic profiles and assumed to be <10 m thick; interpretation of Hubscher et al. (2015)
320 - 566	Seismic unit pre-K1: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene/ Pliocene?	1900	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	80	Interpretation of Hubscher et al. (2015)

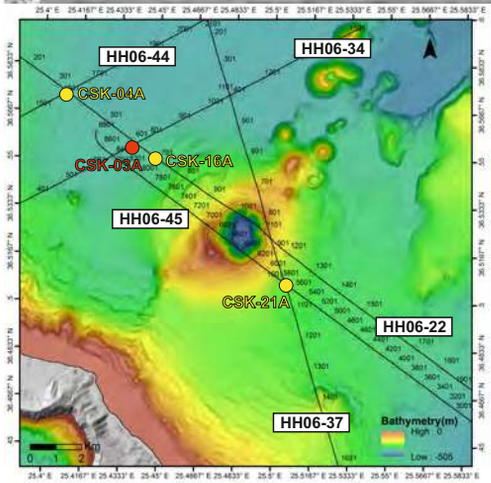
CSK-03A











CSK-03A: HH06-34-REPROC, CDP 760 (a and c); HH06-22-REPROC, CDP 614 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-03A_location.pdf
SEGY-data data: HH06-34-REPROC.sgy, HH06-22-REPROC.sgy
Navigation data: HH06-34-REPROC.txt, HH06-22-REPROC.txt
Bathymetry:CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site information:
Coordinates: 36.5549/25.4398
Water depth: 397 m
Penetration: 566 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile.

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-04A lies in the Anhydros Basin on the NW submarine flank of Kolumbo Seamount Volcano. The aim is to penetrate seismically recognized volcanic eruption units from Kolumbo, as well as many units from Santorini. This will enable characterisation of the products of the Kolumbo eruptions, as well as construction of a coherent stratigraphy for Santorini and Kolumbo together. However this site only clearly transects one Kolumbo eruption unit (K5), and has been replaced by site CSK-21A, which is better placed for our objectives. We retain CSK-04A, as it may transect thin distal equivalents of K1-K5.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-04A	Area or Location:	Anhydros Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.5728	Distance to Land: (km)	10
Longitude:	Deg: 25.4092		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ☑	Water Depth (m):	402

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	545	0
Total Sediment Thickness (m)	545	
Total Penetration (m):	545	

General Lithologies: Muds, volcaniclastics, debris flows, turbidites

Coring Plan: (Specify or check): 3 Holes APC/HLAPC to refusal, each followed by XCB to 545 mbsf including 10 meters into basement or until refusal; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☐ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 8.2 | Logging: 1.3 | Total On-site: 9.5

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-04A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: HH06-22-REPROC Position: CDP 345
1b High resolution seismic seismic reflection (crossing)	yes	Line: HH06-44-REPROC Position: CDP 1626
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	yes	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	~3.5m long gravity core and a box corer (POS513/19), 7 km from site position showing hemipelagic muds with some 1 to 20 cm thick intercalated ash layers (max grain size= 2 mm); Sedimentation rate ~6 cm/ka .
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	HH06-22-REPROC.txt, HH06.44-REPROC.txt
17 Other	no	

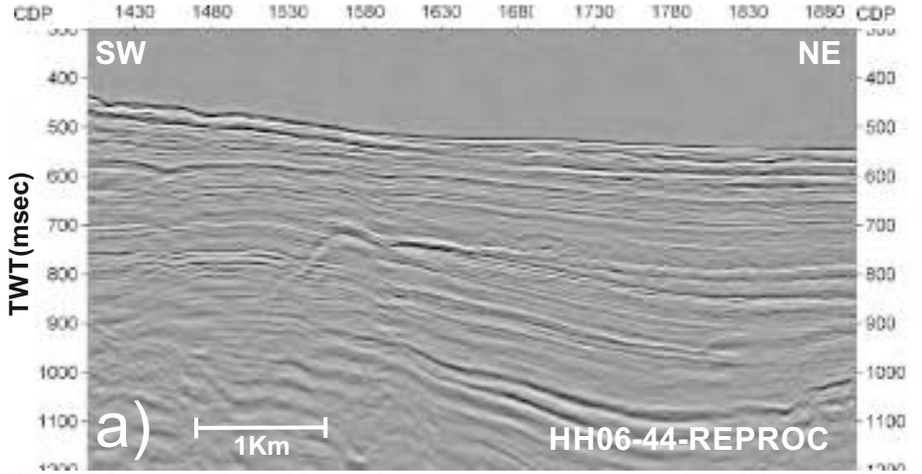
Proposal #: 932 - Add	Site #: CSK-04A	Date Form Submitted: 2019-11-22 13:07:02

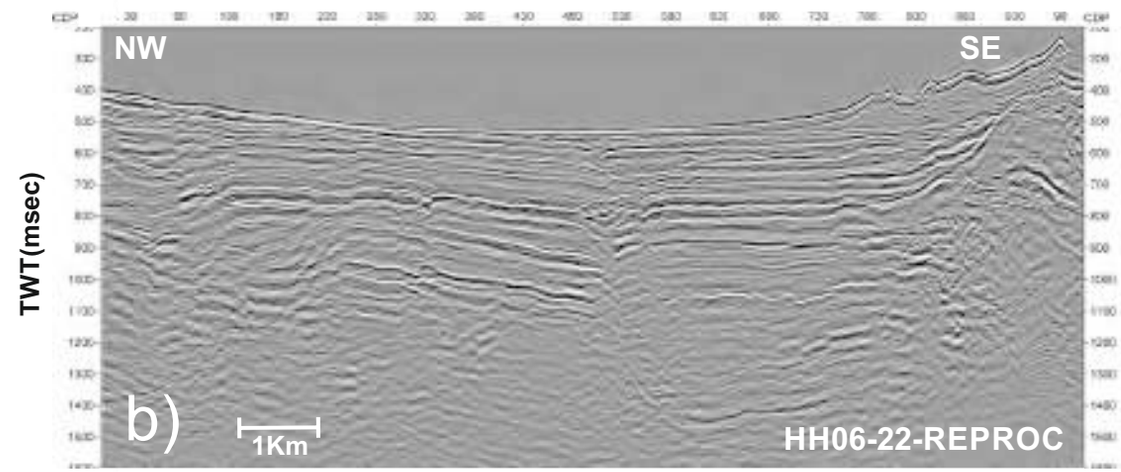
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Tripple APC/HLAPC (Holes A, B, C) to refusal including 4 temperature measurements, each followed by XCB to 545 mbsf; log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	Target drill depth may be to deep for XCB only and fine to coarse volcaniclastic in the top 10 meters may be be difficult to penetrate

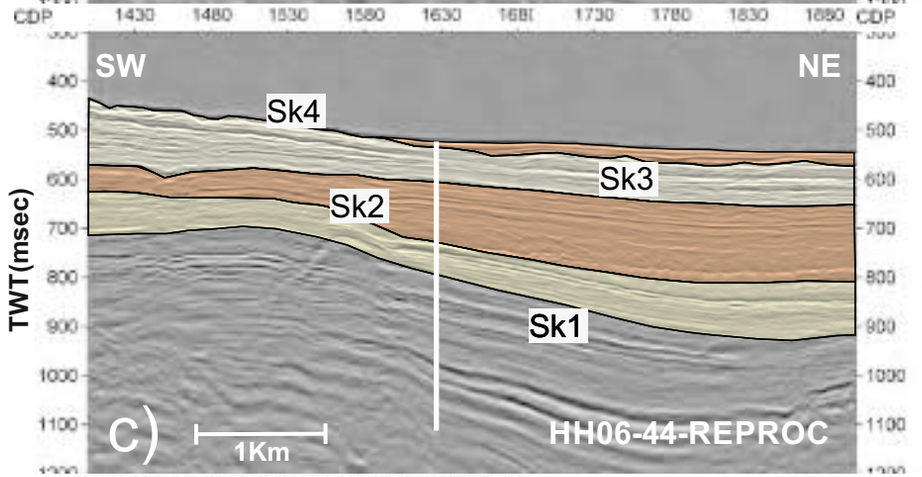
Proposal #: 932 - Add	Site #: CSK-04A	Date Form Submitted: 2019-11-22 13:07:02

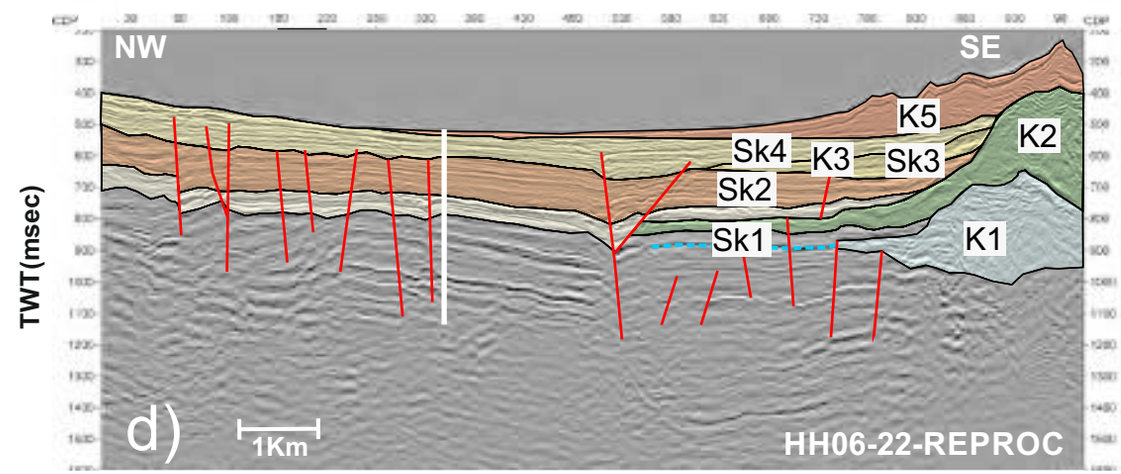
Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 8	Seismic unit K5: AD 1650 eruption of Kolumbo	0.0036	1.65	Volcaniclastics (pumiceous)	filled submarine rift-basin	>1,000,000	Interpretation of Hubscher et al. (2015)
8 - 56	Seismic unit SK4: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Holocene/ Upper Pleistocene	1.7	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	130	Interpretation of Hubscher et al. (2015)
56 - 184	Seismic unit SK3: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	120	Interpretation of Hubscher et al. (2015)
184 - 254	Seismic unit SK2: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	110	Interpretation of Hubscher et al. (2015)
254 - 545	Seismic unit SK1: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene/ Pliocene?	1.9	hemipelagic miuds, volcaniclastics, turbidites, MTDs	filled submarine rift-basin	100	Interpretation of Hubscher et al. (2015)

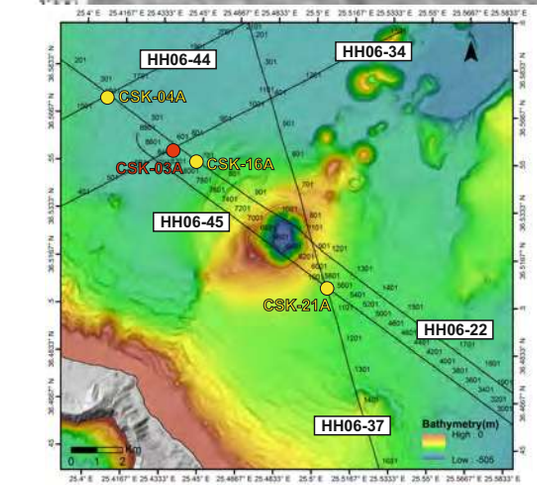
CSK-04A











CSK-04A: HH06-44-REPROC, CDP 1626 (a and c); HH06-22-REPROC, CDP 345 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-04A_location.pdf
SEGY-data data: HH06-44-REPROC.sgy, HH06-22-REPROC.sgy
Navigation data: HH06-44-REPROC.txt, HH06-22-REPROC.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site information:
Coordinates:36.5728/25.4092
Water depth: 402 m
Penetration: 545 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-05B is sited in the northern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them and confirm (or not) published hypotheses, as well as to penetrate below unit S3 (probably intracaldera tuff of the LBA eruption). The hole is located north of a low-velocity seismic anomaly detected by the PROTEUS seismic tomography experiments and centered on the focus of caldera floor uplift during the unrest period of 2011-12. It replaces hole CSK-05A in FULL.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini. Onland drilling on Kameni islands to 200 m depth in 1987-88.

Section B: General Site Information

Site Name:	CSK-05B	Area or Location:	Santorini caldera (northern basin), Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.4356	Distance to Land: (km)	2
Longitude:	Deg: 25.3806		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ✓ Alternate:	Water Depth (m):	385

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	360	0
Total Sediment Thickness (m)	360	
Total Penetration (m):	360	

General Lithologies: Coarse intracaldera sediments, breccias, landslides, lavas, muds

Coring Plan: (Specify or check): 2 Holes APC/HLAPC/XCB to refusal; drill ahead in Hole C to 130 mbsf and RCB to 360 mbsf; wirleline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 4.3 | Logging: 0.9 | Total On-site: 5.2

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas ☐	Complicated Seabed Condition ☐	Hydrothermal Activity ☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon ☐	Soft Seabed ☐	Landslide and Turbidity Current ☐	
Shallow Water Flow ☐	Currents ☐	Gas Hydrate ☐	
Abnormal Pressure ☐	Fracture Zone ☐	Diapir and Mud Volcano ☐	
Man-made Objects (e.g., sea-floor cables, dump sites) ☐	Fault ☐	High Temperature ☐	
H_2S ☐	High Dip Angle ☐	Ice Conditions ☐	
CO_2 ☐			

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping. Multiple cruise liners in the summer months. No bright spots indicative of gas to the 400 mbsf on available seismic profiles.

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-05B	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: GEOMAR_P1006 Position: CDP 20079
1b High resolution seismic seismic reflection (crossing)	yes	Line: GEOMAR_P3004 Position: CDP 1259
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	Mostly Box corer from 2006 R/V Aegeao expedition of variable length up to 1 m. Mixture of hemipelagic muds and volcaniclastics
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	GEOMAR_P1006.txt, GEOMAR_P3004.txt
17 Other	no	

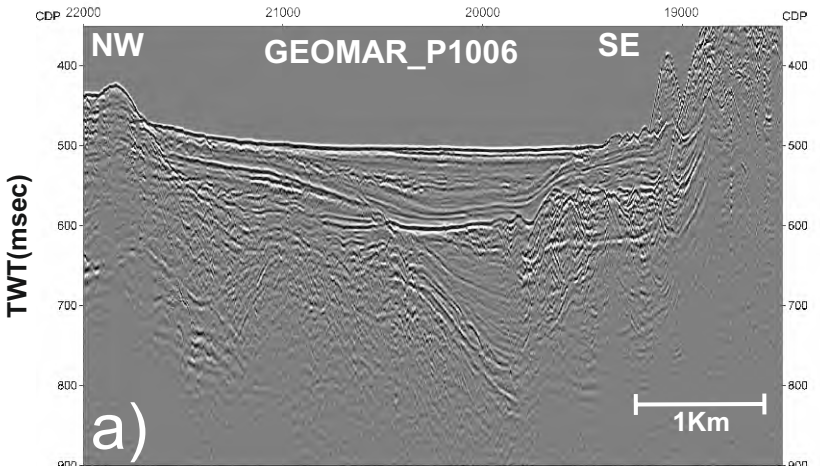
Proposal #: 932 - Add	Site #: CSK-05B	Date Form Submitted: 2019-11-22 13:07:02

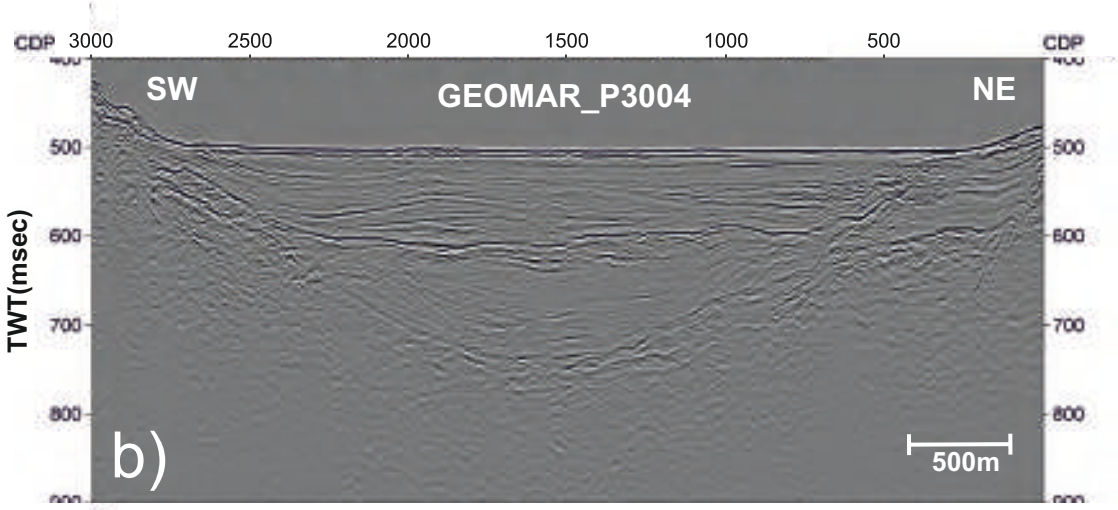
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC/XCB to refusal including 4 temperature measurements, Hole C: RCB drilling ahead until 130 mbsf, RCB to 360 mbsf; log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	heavy ship traffic in the Caldera but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	coarse clastics and lava blocks

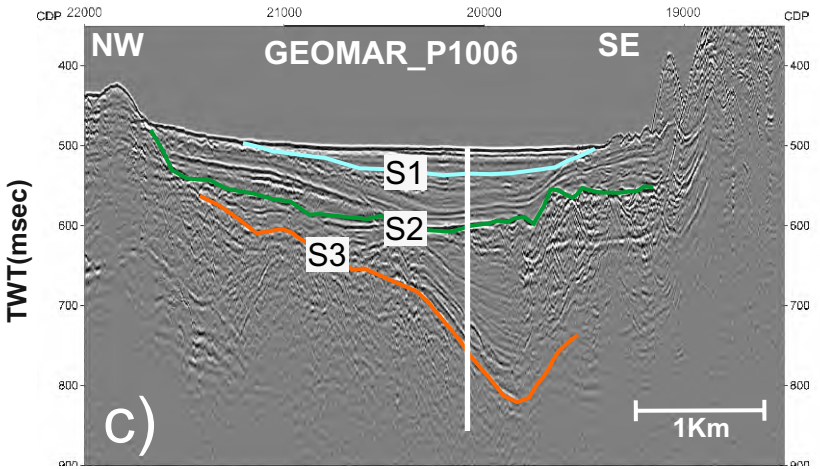
Proposal #: 932 - Add	Site #: CSK-05B	Date Form Submitted: 2019-11-22 13:07:02

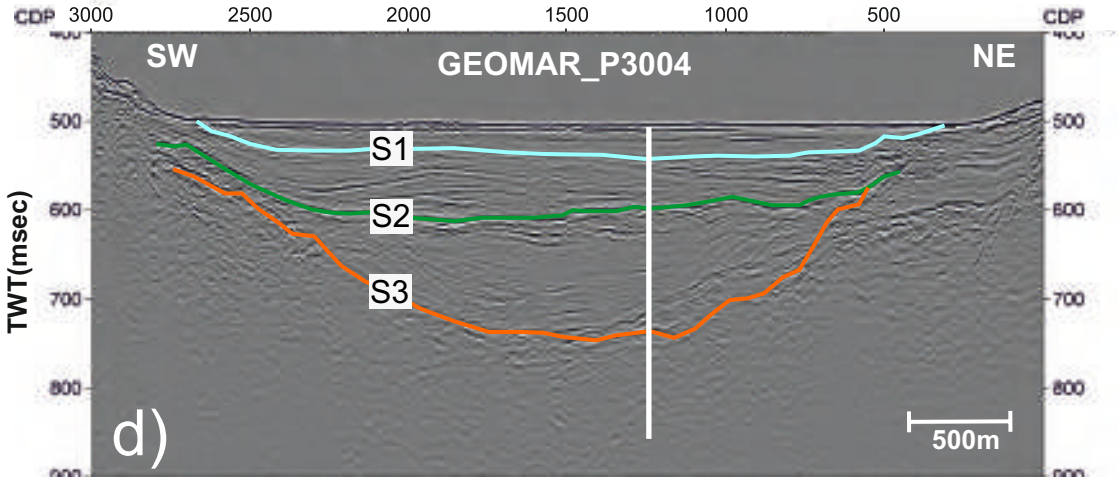
Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 30	Seismic unit S1; subaerial eruptions and mass wasting of caldera cliffs	<0.0020	1.6	volcaniclastics, turbidites, debris flows, muds	Intra caldera fill	15,000	Interpretation from Johnston et al. (2015)
30 - 88	Seismic unit S2; mainly submarine eruptions of Kameni Volcano	0.0036 to 0.0020	1.8	volcaniclastics, muds	Intra-caldera fill	35,000	Interpretation from Johnston et al. (2015)
88 - 186	Seismic unit S3: end of LBA eruption; caldera flooding	0.0036	1.9	coarse gravels, tuffs, debris avalanches, debris flows	Intra-caldera fill	>1,000,000	Interpretation from Johnston et al. (2015) and Nomikou et al. (2016a)
186 - 360	Pre-S3: Late Bronze Age eruption (top of intracaldera tuffs)	3600 years	2.0	Blocky unwelded tuffs, with possible welded layers and lavas	Intra-caldera fill	>1,000,000	Interpretation of Johnston et al. (2015) and Nomikou et al. (2016a)

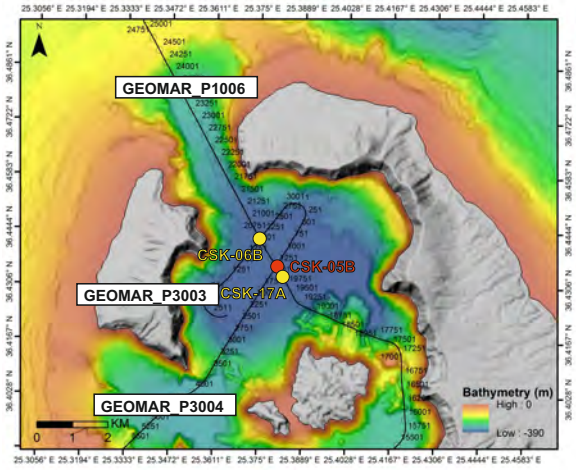
CSK-05B











CSK-05B: GEOMAR_P1006, CDP 20079 (a and c); GEOMAR_P3004, CDP 1259 (b and d)

Location map: CSK-05B_location.pdf
SEGY-data data: GEOMAR_P1006.sgy; GEOMAR_P3004.sgy
Navigation data: GEOMAR_P1006.txt, GEOMAR_P3004.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.4356/25.3806
Water depth: 385 m
Penetration: 360 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-06B is sited in the northern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them and confirm (or not) published hypotheses, as well as to penetrate below unit S3 (probably intracaldera tuff of the LBA eruption). It replaces site CSK-06A in FULL.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini. Onland drilling on Kameni islands to 200 m depth in 1987-88.

Section B: General Site Information

Site Name:	CSK-06B	Area or Location:	Santorini caldera (northern basin), Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.4423	Distance to Land: (km)	2
Longitude:	Deg: 25.3752		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ☑	Water Depth (m):	383

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	360	0
Total Sediment Thickness (m)	360	
Total Penetration (m):	360	

General Lithologies: Coarse intracaldera sediments, breccias, landslides, lavas, muds

Coring Plan: (Specify or check): 2 Holes APC/HLAPC/XCB to refusal; drill ahead in Hole C to 130 mbsf and RCB to 360 mbsf; wirleline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 4.3 | Logging: 0.9 | Total On-site: 5.2

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping. Multiple cruise liners in the summer months. No bright spots indicative of gas to the 400 mbsf on available seismic profiles

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-06B	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: GEOMAR_P1006 Position: CDP 20648
1b High resolution seismic seismic reflection (crossing)	yes	Line: GEOMAR_P3003 Position: CDP 2159
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	Mostly Box corer from 2006 R/V Aegeao expedition of variable length up to 1 m. Mixture of hemipelagic muds and volcaniclastics
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	GEOMAR_P1006.txt, GEOMAR_P3003.txt
17 Other	no	

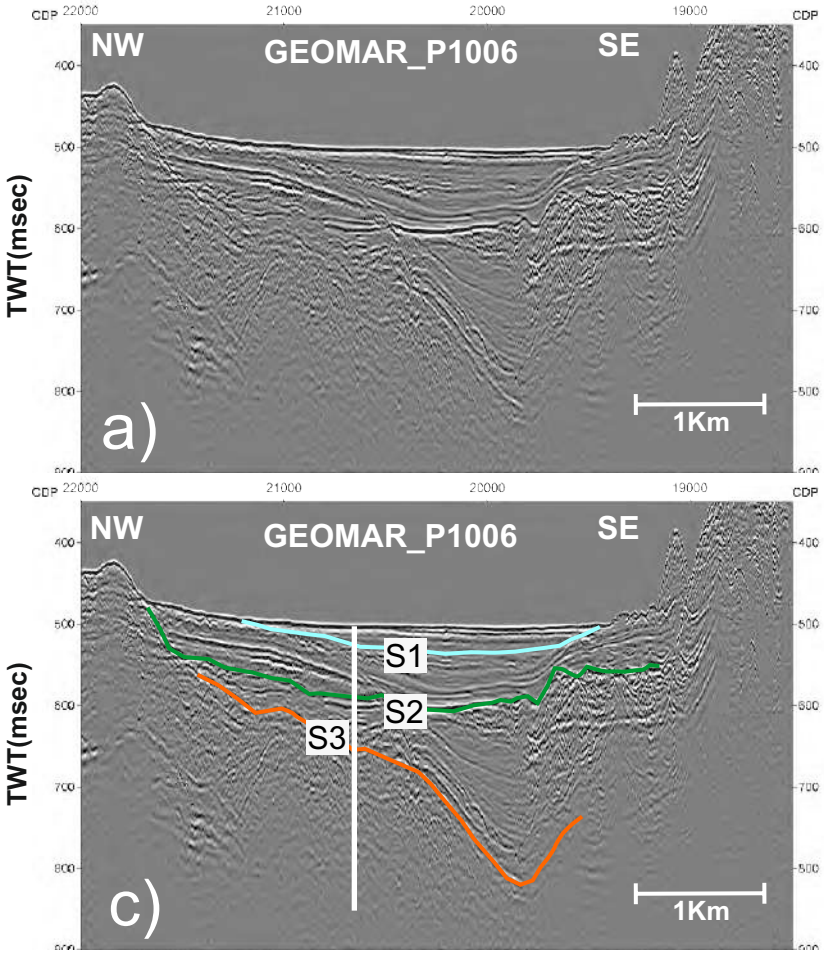
Proposal #: 932 - Add	Site #: CSK-06B	Date Form Submitted: 2019-11-22 13:07:02

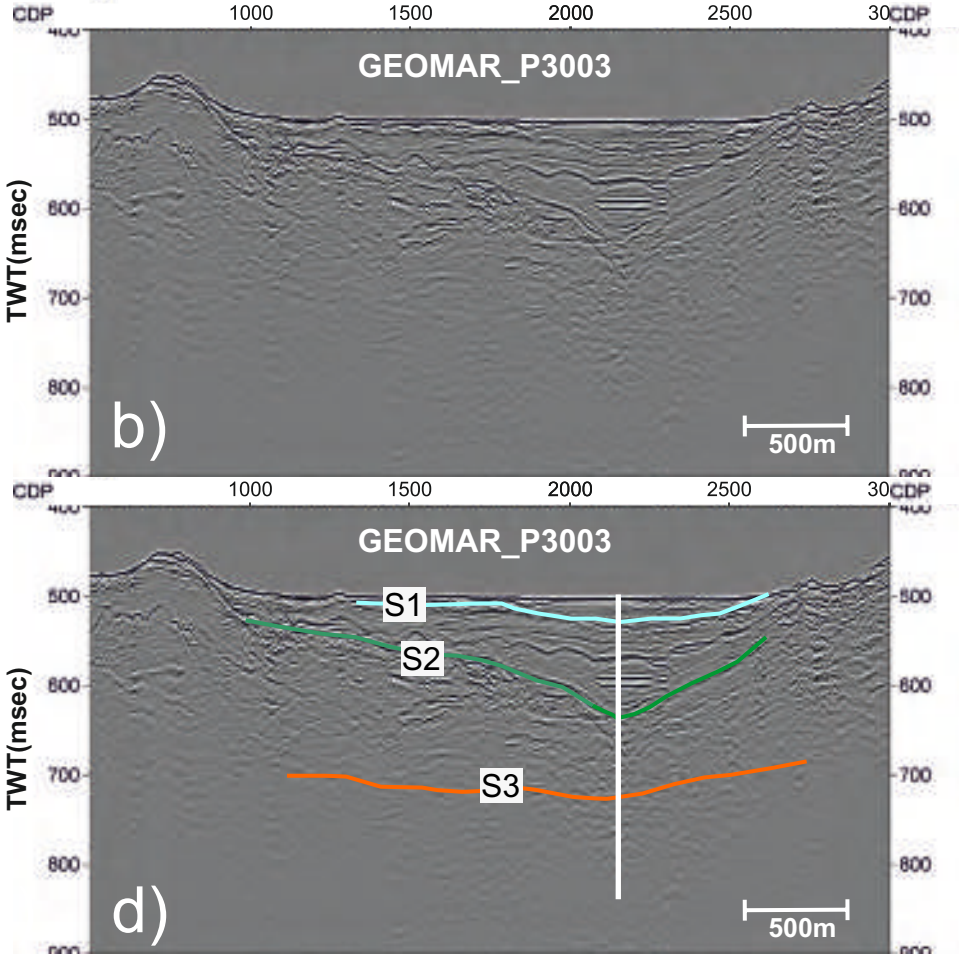
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC/XCB to refusal including 4 temperature measurements, Hole C: RCB drilling ahead until 130 mbsf, RCB to 360 mbsf; log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	heavy ship traffic in the Caldera but but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	coarse clastics and lava blocks

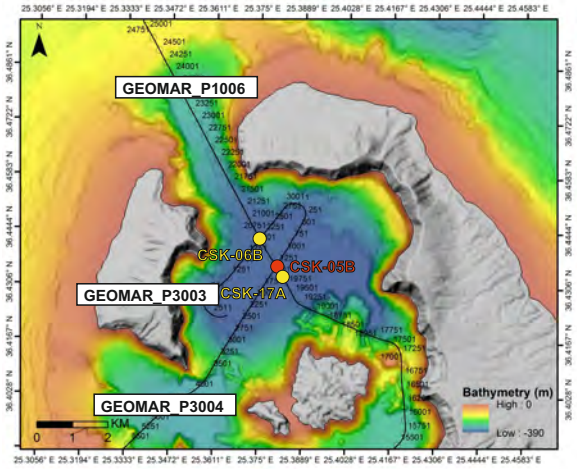
Proposal #: 932 - Add	Site #: CSK-06B	Date Form Submitted: 2019-11-22 13:07:02

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 14	Seismic unit S1: Subaerial eruptions and mass wasting off the caldera cliffs	<0.0020	1.6	volcaniclastics, turbidites, debris flows, muds	Intra caldera fill	7000	Interpretation from Johnston et al. (2015)
14 - 76	Seismic unit S2: mainly submarine eruptions of Kameni Volcano	0.0036 to 0.0020	1.8	volcaniclastics, muds	Intra-caldera fill	38,000	Interpretation from Johnston et al. (2015)
76 - 104	Seismic unit S3: end of LBA eruption; caldera flooding	0.0036	1.9	Coarse gravels, tuffs, debris avalanches, debris flows	Intra-caldera fill	>1,000,000	Interpretation from Johnston et al. (2015) and Nomikou et al. (2016a)
104 - 360	Pre-S3: Late Bronze Age eruption (top of intracaldera tuffs)	3600	2.0	Blocky unwelded tuffs, with possible welded layers and lavas	Intra-caldera fill	>1,000,000	Interpretation of Johnston et al. (2015) and Nomikou et al. (2016a)

CSK-06B







CSK-06B: GEOMAR_P1006, CDP 20648 (a and c); GEOMAR_P3003, CDP 2159 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-06B_location.pdf
SEGY-data data: GEOMAR_P1006.sgy; GEOMAR_P3003.sgy
Navigation data: GEOMAR_P1006.txt, GEOMAR_P3003.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.4423/25.3752
Water depth: 383 m
Penetration: 360 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-07B is sited in the southern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them, as well as to penetrate below unit S3 (probable intracaldera tuff of the LBA eruption). This site is complementary to sites CSK-05B/06B in the northern caldera basin, as together they will provide a complete understanding of the caldera fill and collapse history. It replaces site CSK-07A in FULL.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini. Onland drilling on Kameni islands to 200 m depth in 1987-88.

Section B: General Site Information

Site Name:	CSK-07B	Area or Location:	Santorini caldera (southern basin), Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.38895	Distance to Land: (km)	1
Longitude:	Deg: 25.41713		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ✓ Alternate: ☐	Water Depth (m):	292

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	360	0
Total Sediment Thickness (m)	360	
Total Penetration (m):	360	

General Lithologies: Coarse intracaldera sediments, breccias, landslides, lavas, muds

Coring Plan: (Specify or check): 2 Holes APC/HLAPC/XCB to refusal, followed by drill ahead to 175 mbsf and RCB to 360 mbsf, wirleline logging in RCB Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 4.4 | Logging: 1 | Total On-site: 5.4

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping. Multiple cruise liners in the summer months. No bright spots indicative of gas on seismic profiles.

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-07B	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: GEOMAR_P1006 Position: CDP 15234
1b High resolution seismic seismic reflection (crossing)	yes	Line: SBL20060504_052810-REPROC Position: CDP 234
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	Mostly Box corer from 2006 R/V Aegeao expedition of variable length up to 1 m. Mixture of hemipelagic muds and volcaniclastics
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	GEOMAR_P1006.txt, 20060504_052810-REPROC
17 Other	no	

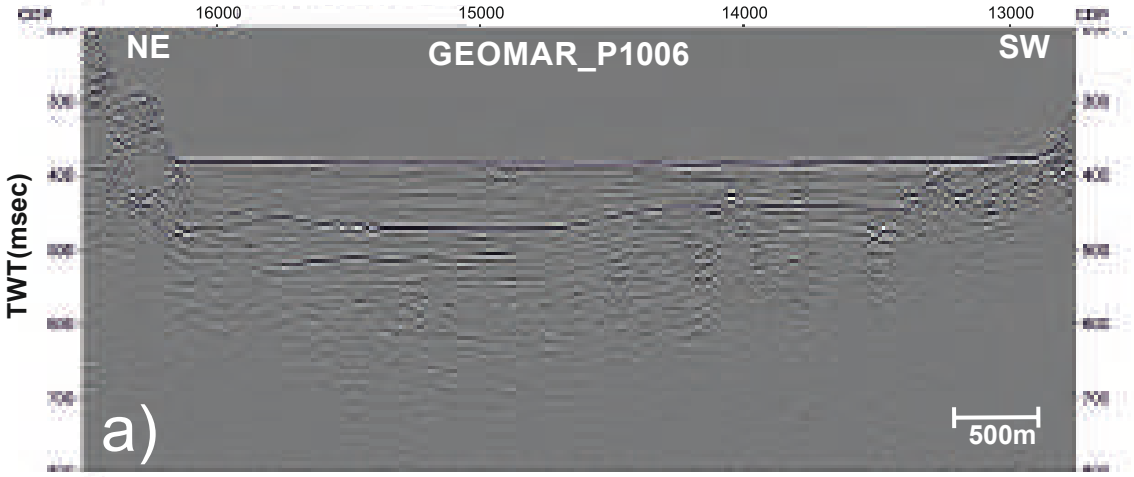
Proposal #: 932 - Add	Site #: CSK-07B	Date Form Submitted: 2019-11-22 13:07:02

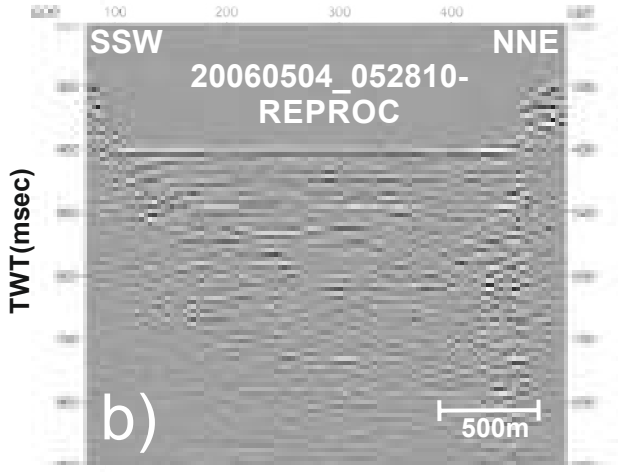
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to refusal; Hole C: RCB drilling ahead until 175 mbsf, RCB to 360 mbsf, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	heavy ship traffic in the Caldera but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	coarse clastics and lava blocks

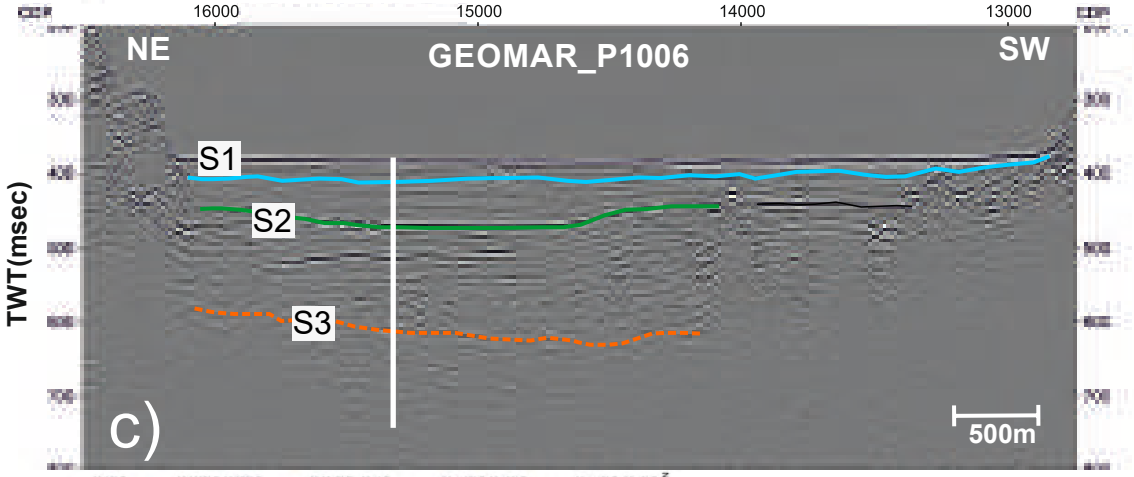
Proposal #: 932 - Add	Site #: CSK-07B	Date Form Submitted: 2019-11-22 13:07:02

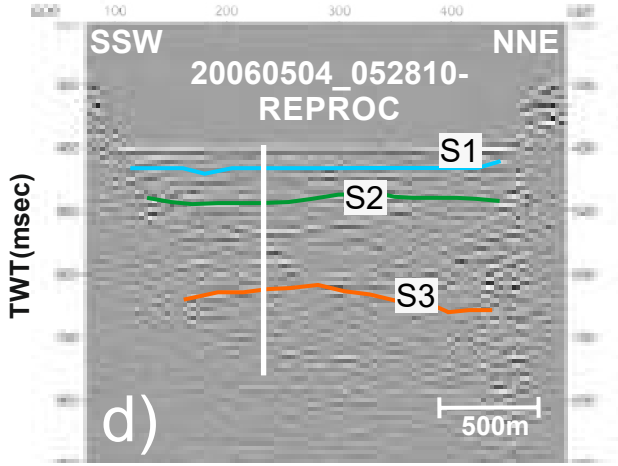
Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 20	Seismic unit S1: subaerial eruptions and mass wasting of the caldera cliffs	<0.0020	1.6	volcaniclastics, turbidites, debris flows, muds	intra caldera fill	10,000	Interpretation from Johnston et al. (2015)
20 - 77	Seismic unit S2: mainly submarine eruptions of Kameni Volcano	0.0036 to 0.0020	1.8	volcaniclastics, muds	Intra-caldera fill	36,000	Interpretation from Johnston et al. (2015)
77 - 218	Seismic unit S3: end of LBA eruption; caldera flooding	0.0036	1.9	Coarse gravels, tuffs, debris avalanches, debris flows	Intra-caldera fill	>1,000,000	Interpretation from Johnston et al. (2015) and Nomikou et al. (2016a)
218 - 360	Sub-S3: Late Bronze Age eruption (top of intracaldera tuffs)	0.0036	2.0	Blocky unwelded tuffs, with possible welded layers and lavas	Intra-caldera fill	>1,000,000	Interpretation of Johnston et al. (2015)

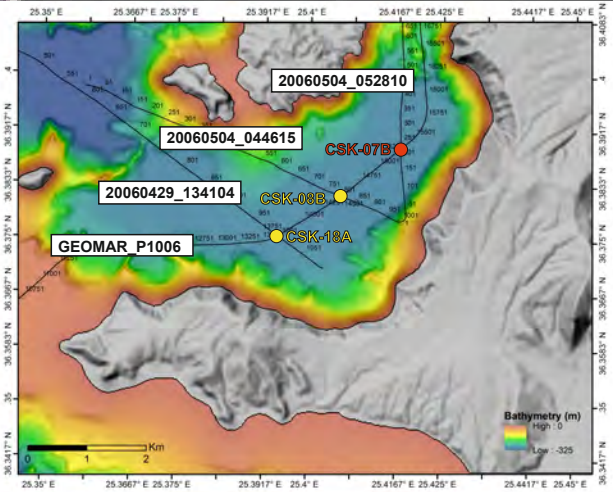
CSK-07B











CSK-07B: GEOMAR_P1006, CDP 15324 (a and c); 20060504_052810-REPROC, CDP 234 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-07B_location.pdf
SEGY-data data: GEOMAR_P1006.sgy, 20060504_052810-REPROC.sgy
Navigation data: GEOMAR_P1006.txt, 20060504_052810-REPROC.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.38895/
25.41713
Water depth: 292 m
Penetration: 360 m

Additional data available:
Magnetic: CSK_Magnetic.grd, CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-08B is sited in the southern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them, as well as to penetrate below unit S3 (probable intracaldera tuff of the LBA eruption). This site is complementary to sites CSK-05B/06B in the northern caldera basin, as together they will provide a complete understanding of the caldera fill and collapse history. Site CSK-08 replaces CSK-08A in FULL.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini. Onland drilling on Kameni islands to 200 m depth in 1987-88.

Section B: General Site Information

Site Name:	CSK-08B	Area or Location:	Santorini caldera (southern basin), Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.38161	Distance to Land: (km)	1
Longitude:	Deg: 25.40606		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ☑	Water Depth (m):	293

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	375	0
Total Sediment Thickness (m)	375	
Total Penetration (m):	375	

General Lithologies: Coarse intracaldera sediments, breccias, landslides, lavas, muds

Coring Plan: (Specify or check): 2 Holes APC/HLAPC/XCB to refusal, followed by drill ahead to 175 mbsf and RCB to 375 mbsf, wirleline logging in RCB Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 4.5 | Logging: 1 | Total On-site: 5.5

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping. Multiple cruise liners in the summer months. No bright spots indicative of gas on seismic profiles.

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-08B	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: GEOMAR_P1006 Position: CDP 14501
1b High resolution seismic seismic reflection (crossing)	yes	Line: SBL20060504_044615-REPROC Position: CDP 801
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	yes	Data and info see Site CSK-01A
7 Swath bathymetry	yes	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	Mostly Box corer from 2006 R/V Aegeao expedition of variable length up to 1 m. Mixture of hemipelagic muds and volcaniclastics
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	GEOMAR_P1006.txt, 20060504_044615-REPROC.txt
17 Other	no	

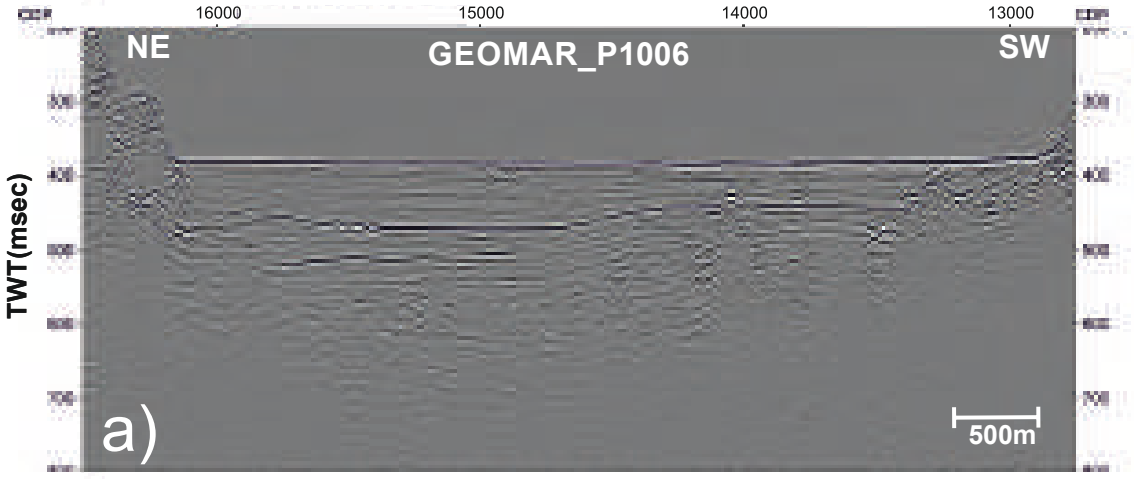
Proposal #: 932 - Add	Site #: CSK-08B	Date Form Submitted: 2019-11-22 13:07:02

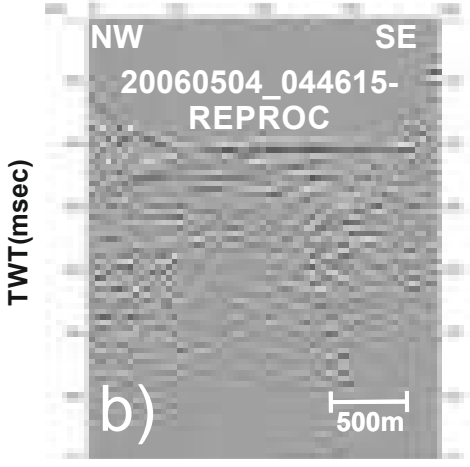
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to refusal; Hole C: RCB drilling ahead until 175 mbsf, RCB to 375 mbsf, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	heavy ship traffic in the Caldera but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	coarse clastics and lava blocks

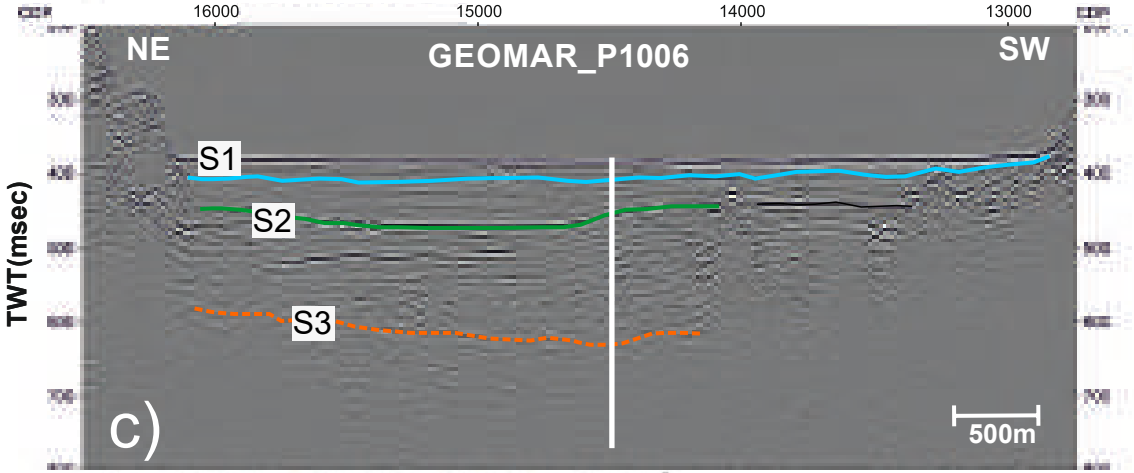
Proposal #: 932 - Add	Site #: CSK-08B	Date Form Submitted: 2019-11-22 13:07:02

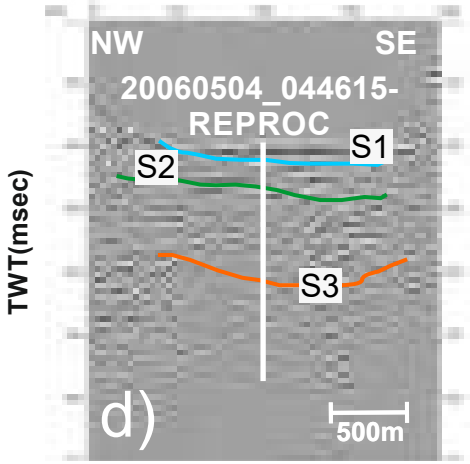
Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 16	Seismic unit S1: subaerial eruptions and mass wasting of the caldera cliffs	<0.0020	1.6	volcaniclastics, turbidites, debris flows, muds	intra caldera fill	8000	Interpretation from Johnston et al. (2015)
16 - 75	Sesimic unit S2: mainly submarine eruptions of Kameni Volcano	0.0036 to 0.0020	1.8	volcaniclastics, muds	Intra-caldera fill	36,000	Interpretation of Johnston et al. (2015)
75 - 142	Seismic unit S3: End of LBA eruption; caldera flooding	0.0036	1.9	Coarse gravels, tuffs, debris avalanches, debris flows	Intra-caldera fill	>1,000,000	Interpretation from Johnston et al. (2015)
142 - 375	Pre-S3: Late Bronze Age eruption (top of intracaldera tuff)	0.0036	2.0	Blocky unwelded tuffs, with possible welded layers or lavas	Intra-caldera fill	>1,000,000	Interpretation of Johnston et al. (2015) and Nomikou et al. (2016a)

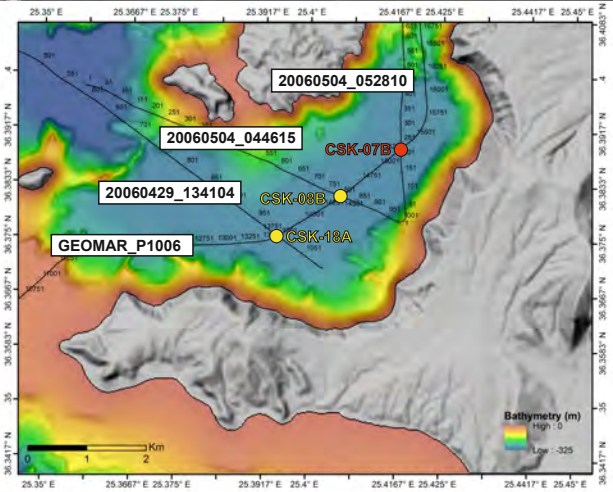
CSK-08B











CSK-08B: GEOMAR_P1006, CDP 14501 (a and c); 20060504_044615-REPROC, CDP 801 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-08B_location.pdf
SEGY-data data: GEOMAR_P1006.sgy, 20060504_044615-REPROC.sgy
Navigation data: GEOMAR_P1006.txt, 20060504_044615-REPROC.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.38161/
25.40606
Water depth: 293 m
Penetration: 375 m

Additional data available:
Magnetic: CSK_Magnetic.grd, CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-09A is sited in the Anafi Basin. The aim is to penetrate the entire volcano-sedimentary fill of this basin as far as the Alpine basement. The basin potentially records the full volcanic history of Santorini (and any older centres) since rift inception, but not of Kolumbo Volcano. The hole will reconstruct the subsidence and sedimentary history of this basin, to compare with that of the Anhydros Basin. It will transect all six seismic units present in the basin (B1 to B6).
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-09A	Area or Location:	Anafi Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.5656	Distance to Land: (km)	9
Longitude:	Deg: 25.7613		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ✓ Alternate: ☐	Water Depth (m):	694

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	585	10
Total Sediment Thickness (m)	585	
Total Penetration (m):	595	

General Lithologies:	Muds, volcaniclastics, debris flows, turbidites / Limestone, schist or granite
Coring Plan: (Specify or check)	3 Holes APC/HLAPC to refusal, each followed by XCB to 595 mbsf including 10 meters into basement or until refusal, wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☐ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days:	Drilling/Coring: 9.5	Logging: 1.3	Total On-site: 10.8

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas ☐	Complicated Seabed Condition ☐	Hydrothermal Activity ☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon ☐	Soft Seabed ☐	Landslide and Turbidity Current ☐	
Shallow Water Flow ☐	Currents ☐	Gas Hydrate ☐	
Abnormal Pressure ☐	Fracture Zone ☐	Diapir and Mud Volcano ☐	
Man-made Objects (e.g., sea-floor cables, dump sites) ☐	Fault ☐	High Temperature ☐	
H_2S ☐	High Dip Angle ☐	Ice Conditions ☐	
CO_2 ☐			
Sensitive marine habitat (e.g., reefs, vents)			

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-09A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: HH06-15-REPROC Position: CDP 1067
1b High resolution seismic seismic reflection (crossing)	yes	Line: HH06-09-REPROC Position: CDP 3403
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	yes	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	~2m long gravity core (POS513/20), 9 km from site position showing soft hemipelagic muds with carbonate clasts, some cm thick intercalated ash layers and two dm-scaled tephra layers unto coarse ash and fine lapilli (up to 1 cm); Sedimentation rate ~9 cm/ka.
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	HH06-15-REPROC.txt, HH06-09-REPROC.txt
17 Other	no	

IODP Site Forms

Form 4 - Environmental Protection

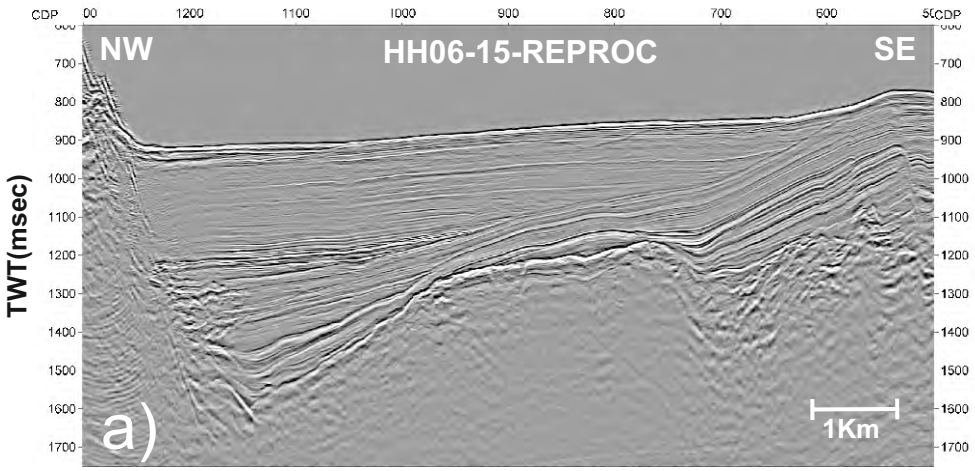
Proposal #: 932 - Add	Site #: CSK-09A	Date Form Submitted: 2019-11-22 13:07:02

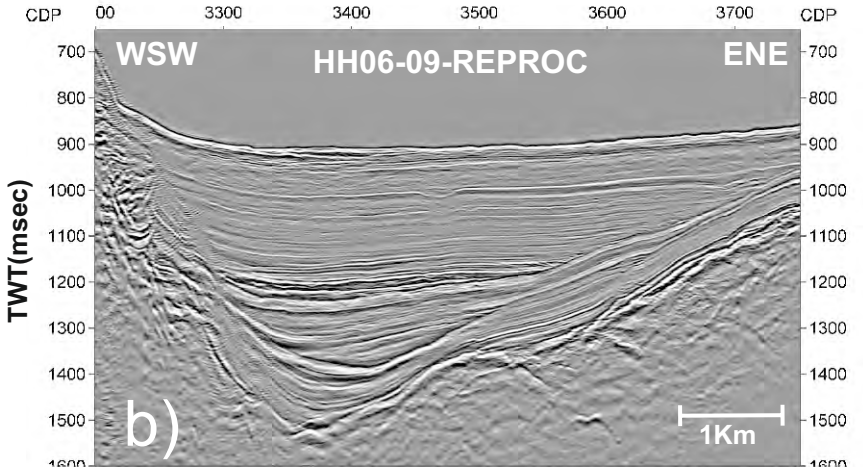
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Tripple APC/HLAPC (Holes A, B, C) to refusal including 4 temperature measurements, each followed by XCB to 595 mbsf including 10 meters of basement or until refusal, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	no
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	Target drill depth for XCB in Holes A and B may be to deep for XCB only but is covered by RCB in Hole C

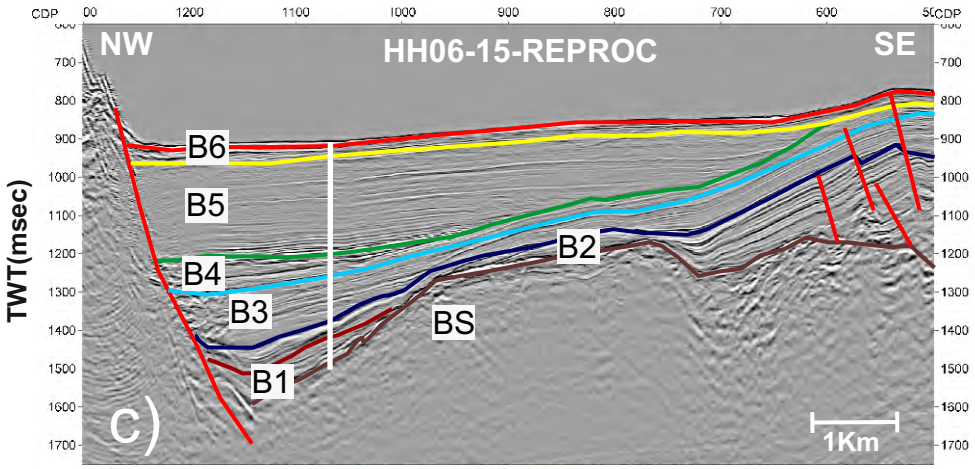
Proposal #: 932 - Add	Site #: CSK-09A	Date Form Submitted: 2019-11-22 13:07:02

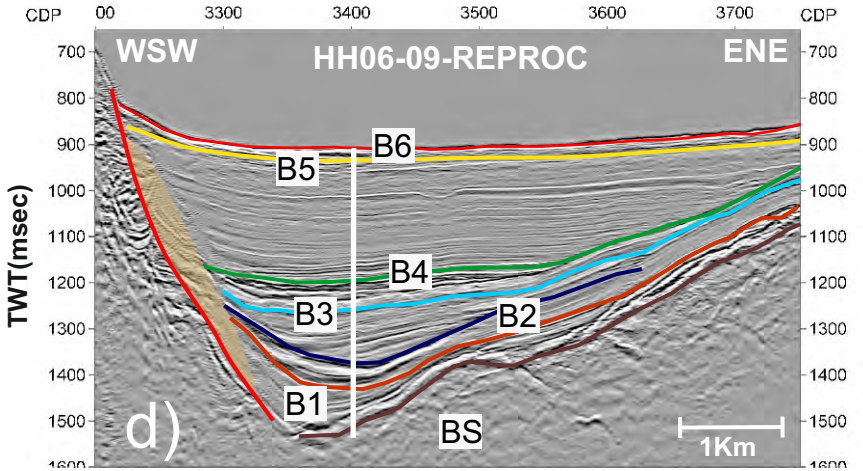
Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 34	Seismic unit B6: horizontal dipping beds and unconformity into B5	Pleistocene/ Holocene	1.6	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	140	lithology similar like in gravity core; interpretation after Nomikou et al. (2018)
34 - 248	Seismic unit B5: subhorizontal dipping beds, several stronger reflectors distributed within the unit; chaotic layering in the upper part?	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	130	chaotic layering implicate kind of mass transport deposits and high sedimentation rate due to tectonics?; interpretation after Nomikou et al. (2018)
248 - 346	Seismic unit B4 with subhorizontal dipping beds, several stronger reflectors distributed within the unit	Early? Pleistocene	2.0	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	120	More turbiditic deposits and subhorizontal layering, tectonics? Interpretation Nomikou et al. (2018)
346 - 461	Seismic unit B3. Subhorizontal bedding, chaotic layer, MTD? Unconformity onto steep layered unit B2.	Early Pleistocene/ Pliocene	2.1	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	120	Chaotic layering implicates mass transport deposits and high sedimentation rate due to tectonics? Interpretation Nomikou et al. (2018)
461 - 507	Seismic unit B2	early Pleistocene?/ Pliocene	2.4	turbidites, hemipelagics, volcaniclastics, MTD´s	filled submarine rift-basin	120	steep bedding assumes tectonics after initial fill. Interpretation Nomikou et al. (2018)
507 - 585	Seismic unit B1; unconformity into continental basement	Pliocene	2.6	MTD´s, sands and gravel, turbidites, hemipelagic muds, volcaniclastics	submarine to continental; initial filling of a rift basin	110	initial filling sequence of the rift with mixed volcaniclastic and continental material. Interpretation Nomikou et al. (2018)
585 - 595	continental basement	Mesozoic	3.0	limestone, shists, granites	continental basement	??	

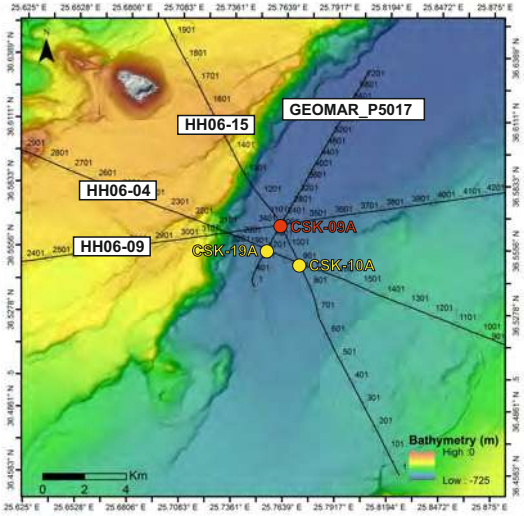
CSK-09A











CSK-09A: HH06-15-REPROC, CDP 1067 (a and c); HH06-09-REPROC, CDP 3403 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-09A-10A_location.pdf
SEGY-data data: HH06-15-REPROC.sgy, HH06-09-REPROC.sgy
Navigation data: HH06-15-REPROC.txt, HH06-09-REPROC.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.5656/25.7613
Water depth: 694 m
Penetration: 595 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-10A is sited in the Anafi Basin. The aim is to penetrate the entire volcano-sedimentary fill of this basin as far as the Alpine basement. The basin potentially records the full volcanic history of Santorini (and any older centres) since rift inception, but not of Kolumbo Volcano. The hole will reconstruct the subsidence and sedimentary history of this basin, to compare with that of the Anhydros Basin. It will transect the topmost five of the six seismic units present in the basin (B2 to B6).
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-10A	Area or Location:	Anafi Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.5494	Distance to Land: (km)	10
Longitude:	Deg: 25.7714		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ✓	Water Depth (m):	672

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	367	10
Total Sediment Thickness (m)	367	
Total Penetration (m):	377	

General Lithologies:	Muds, volcaniclastics, debris flows, turbidites / Limestone, schist or granite
Coring Plan: (Specify or check)	3 Holes APC/HLAPC to refusal, each followed by XCB to 377 mbsf including 10 meters into basement or until refusal, wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☐ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days:	Drilling/Coring: 6.4	Logging: 1	Total On-site: 7.4

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas ☐	Complicated Seabed Condition ☐	Hydrothermal Activity ☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon ☐	Soft Seabed ☐	Landslide and Turbidity Current ☐	
Shallow Water Flow ☐	Currents ☐	Gas Hydrate ☐	
Abnormal Pressure ☐	Fracture Zone ☐	Diapir and Mud Volcano ☐	
Man-made Objects (e.g., sea-floor cables, dump sites) ☐	Fault ☐	High Temperature ☐	
H_2S ☐	High Dip Angle ☐	Ice Conditions ☐	
CO_2 ☐			
Sensitive marine habitat (e.g., reefs, vents)			

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-10A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: HH06-15-REPROC Position: CDP 906
1b High resolution seismic seismic reflection (crossing)	yes	Line: HH06-04-REPROC Position: CDP 1755
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)		
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	~2m long gravity core (POS513/20), 8 km from site position showing soft hemipelagic muds with carbonate clasts, some cm thick intercalated ash layers and two dm-scaled tephra layers unto coarse ash and fine lapilli (up to 1 cm); Sedimentation rate ~9 cm/ka.
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	HH06-15-REPROC.txt, HH06-04-REPROC.txt
17 Other	no	

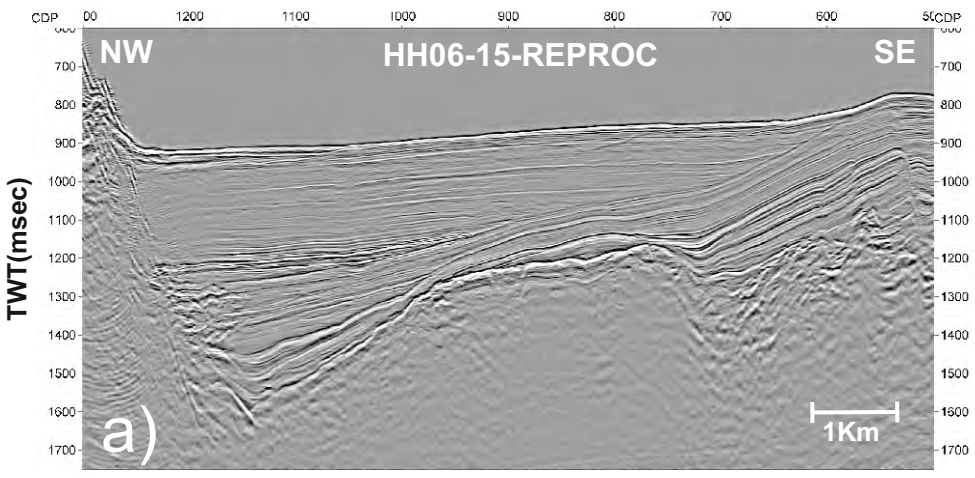
Proposal #: 932 - Add	Site #: CSK-10A	Date Form Submitted: 2019-11-22 13:07:02

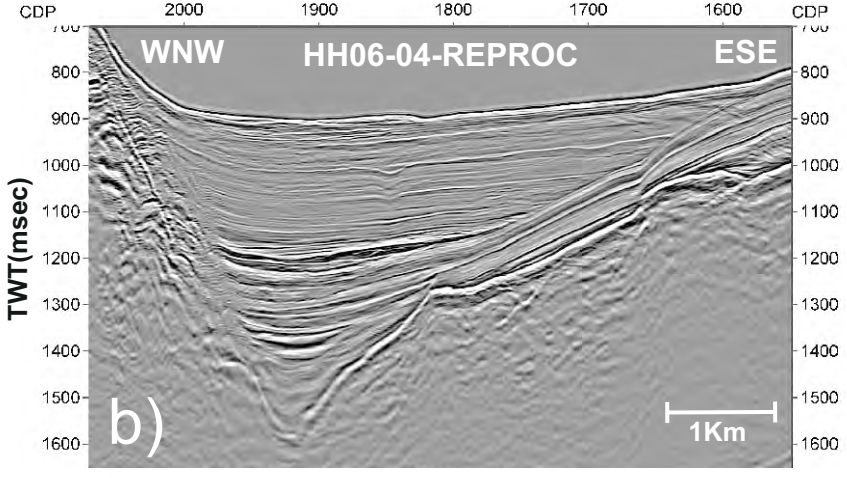
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Tripple APC/HLAPC (Holes A, B, C) to refusal including 4 temperature measurements, each followed by XCB to 377 mbsf including 10 meters of basement or until refusal, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	Target drill depth for XCB in Holes A and B may be to deep for XCB only but is covered by RCB in Hole C

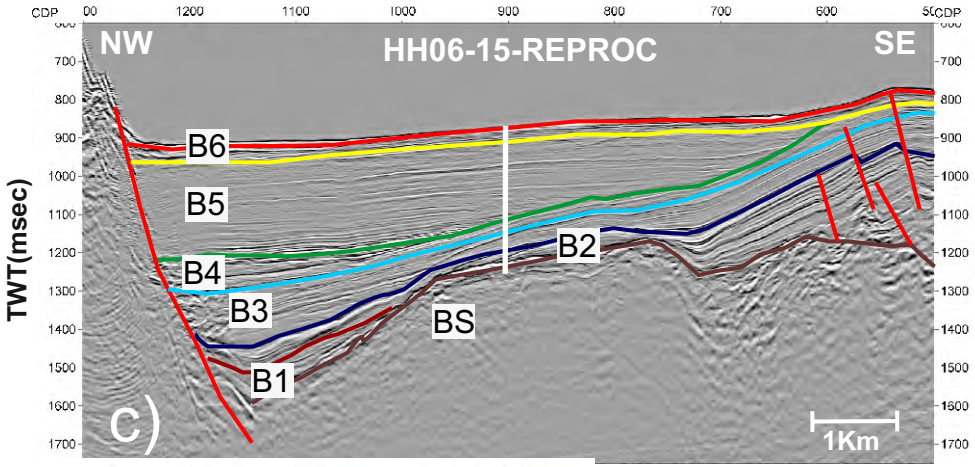
Proposal #: 932 - Add	Site #: CSK-10A	Date Form Submitted: 2019-11-22 13:07:02

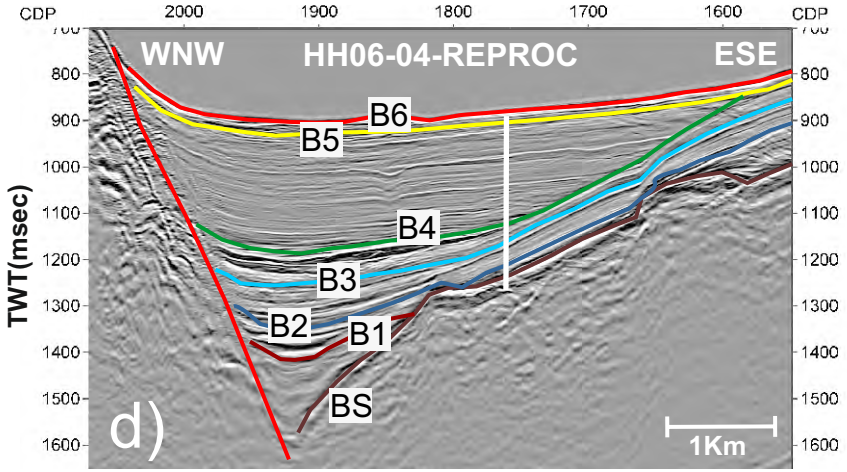
Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 19	Seismic unit B6: horizontal dipping beds and unconformity into B5	Pleistocene/ Holocene	1.6	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	110	lithology similar like in gravity core; interpretation Nomikou et al. (2018)
19 - 217	Seismic unit B5: subhorizontal dipping beds, several stronger reflectors distributed within the unit; chaotic layering in the upper part?	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	100	Interpretation Nomikou et al. (2018)
217 - 255	Seismic unit B4: subhorizontal dipping beds, several stronger reflectors distributed within the unit	Early? Pleistocene	2.0	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	90	Interpretation Nomikou et al. (2018)
255 - 308	Seismic unit B3: subhorizontal bedding, chaotic layer, MTD?, unconformity into steep layered B2	Early Pleistocene/ Pliocene	2.1	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	80	Interpretation Nomikou et al. (2018)
308 - 367	Seismic unit B2; unconformity with basement (unit B1 absent)	early Pleistocene?/ Pliocene	2.4	turbidites, hemipelagics, volcaniclastics, MTD´s	filled submarine rift-basin	70	Interpretation Nomikou et al. (2018)
367 - 377	continental basement	Mesozoic	3.0	limestone, shists, granites	continental basement	??	Interpretation Nomikou et al. (2018)

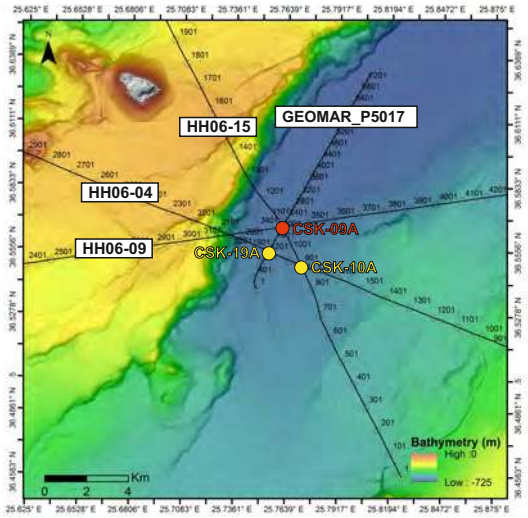
CSK-10A











CSK-10A: HH06-15-REPROC, CDP 906 (a and c); HH06-04-REPROC, CDP 1755 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-09A-10A_location.pdf
SEGY-data data: HH06-15-REPROC.sgy, HH06-04-REPROC.sgy
Navigation data: HH06-15-REPROC.txt, HH06-04-REPROC.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.5494/25.7714
Water depth: 672 m
Penetration: 377 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-13A is sited in the Christiana Basin. This basin is deeper than the Anhydros and Anafi Basins, and is located SW of Santorini. Its volcano-sedimentary fill potentially records the earlier volcanic history of the CSK volcanic field (including the products of Christiana and early Santorini), as well as younger Santorini and possibly Milos Volcano. The hole will pass through alternating volcanic units, including volcaniclastics from Santorini (marine unitsTh1-3, with three possible pyroclastic flow deposits Pf1-3), and volcaniclastics from Christiana (Ch1, 2), to the pre-volcanic basement.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-13A	Area or Location:	Christiana Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.3243	Distance to Land: (km)	10
Longitude:	Deg: 25.1826		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ✓ Alternate:	Water Depth (m):	489

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	847	10
Total Sediment Thickness (m)	847	
Total Penetration (m):	857	

General Lithologies: Muds, volcaniclastics, debris flows, turbidites

Coring Plan: (Specify or check): 2 Holes APC/HLAPC to refusal, each followed by XCB to 675 mbsf; drill ahead in Hole C to 575 mbsf with the option of one or two cored RCB intervals of 50 meters in between and afterwards RCB to 857 mbsf including 10 m of pre volcanic basement; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 10.3 | Logging: 1.8 | Total On-site: 12.1

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-13A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: GEOMAR_P5009 Position: CDP 5042
1b High resolution seismic seismic reflection (crossing)	yes	Line: GEOMAR_P5006 Position: CDP 4431 Not availble yet
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	no	~1m and ~3.5m long gravity cores (POS513/60 and 9), 5 km and 7.8 km from site position showing a) coarse or hardened volcaniclastics after 1 meter of soft hemipelagic muds (Minoan eruption deposits) and b) homogenous hemipelagic muds with some 1 to 20 cm thick intercalated ash layers (max grain size= 2 mm) ; Sedimentation rate ~6 cm/ka in core POS513/9.
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	GEOMAR_P5009.txt, GEOMAR_P5006.txt
17 Other	no	

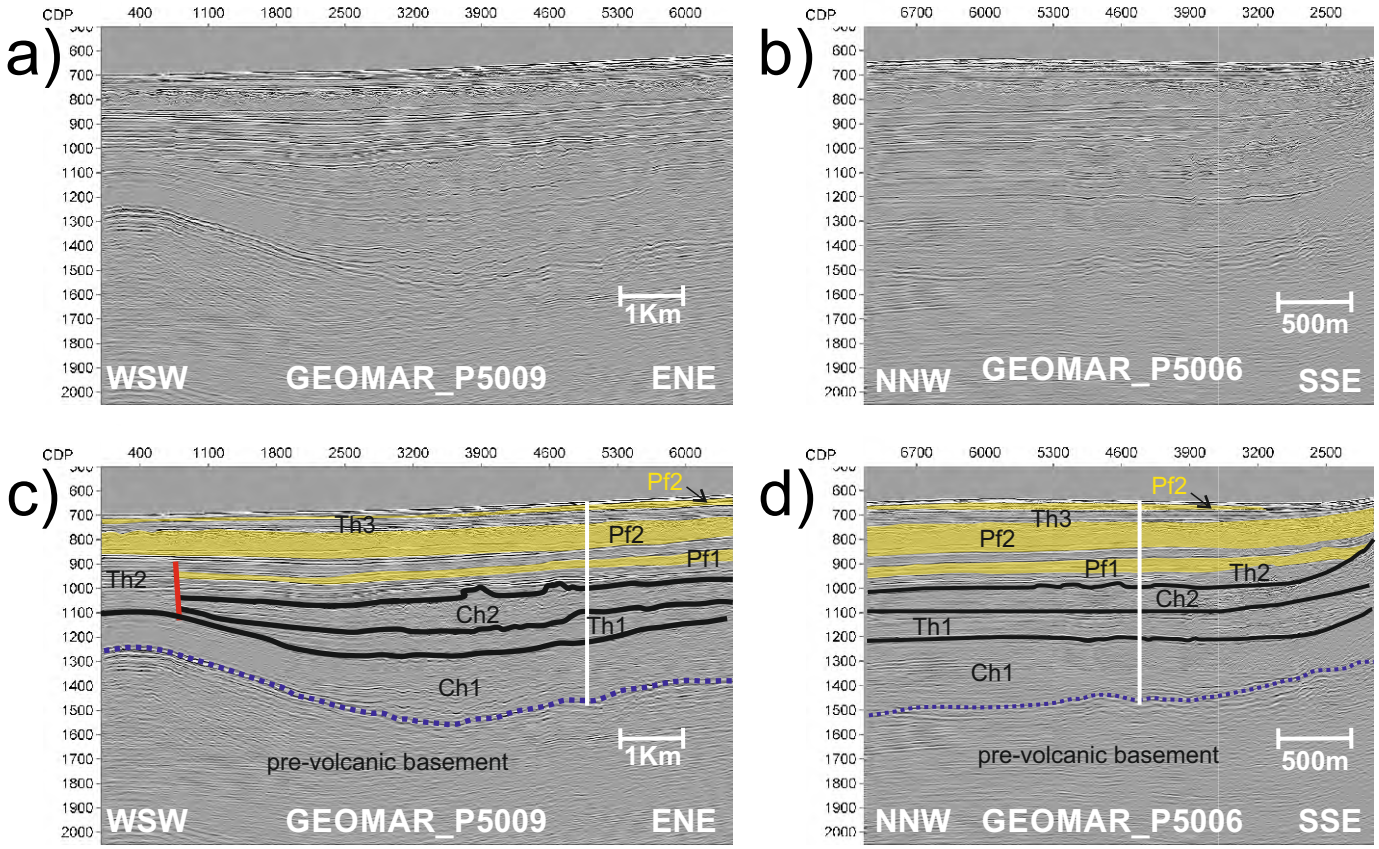
Proposal #: 932 - Add	Site #: CSK-13A	Date Form Submitted: 2019-11-22 13:07:02

Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to 675 mbsf; Hole C: RCB drilling ahead until 575 mbsf with the option of one or two cored intervals of 50 meters in between, RCB to 857 mbsf, including 10 m of pre volcanic basement, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	coarser volcaniclastics from major eruptions

Proposal #: 932 - Add	Site #: CSK-13A	Date Form Submitted: 2019-11-22 13:07:02

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 13	Holocene background sedimentation with some volcanoclastics	<0.0036	1.6	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	3600	Based on interpretation of Tsampouraki-Kraounaki et al. (2018)
13 - 28	Late Bronze Age eruption, submarine pyroclastic flow deposit (Pf3)	0.0036	1.65	Pumiceous tuffs, debris flows and thin overlying surface muds	filled marine basin	>1,000,000	Based on interpretation of Tsampouraki-Kraounaki et al. (2018)
28 - 79	Marine sedimentation (Th3) between pyroclastic flows Pf2 and Pf3	Pleistocene	1.7	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	130	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
79 - 168	Seismic unit Pf2, probable pyroclastic flow deposit from Santorini	Pleistocene; possibly 0.42 My	1.8	Pumiceous tuffs, debris flows	filled marine basin	>1,000,000	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
168 - 209	Marine sedimentation Th2 between seismic units Pf2 and PF1, with volcaniclastics from Christiana, Santorini	Pleistocene/ Pliocene?	1.85	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	100	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
209 - 260	Possible pyroclastic flow deposit (Pf1)	Pleistocene/ Pliocene	1.9	Pumiceous tuffs, debris flows?	filled marine basin	>1,000,000	
260 - 321	Inter-fingering marine sedimentation and pyroclastic flow from Christiana (Ch2) and Pf1	Pliocene	1.95	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	80	
321 - 478	marine sedimentation and pyroclastic flow from Christiana (Ch2)	Pliocene	1.95	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	80	
478 - 847	Marine sedimentation (Th1) passing down into possible volcaniclastics from Christiana (Ch1)	Pliocene	2.0	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	80	
847 - 857	pre-volcanic basement	Mesozoic	3.0	limestone, schists, granites?	continental basement?	?	

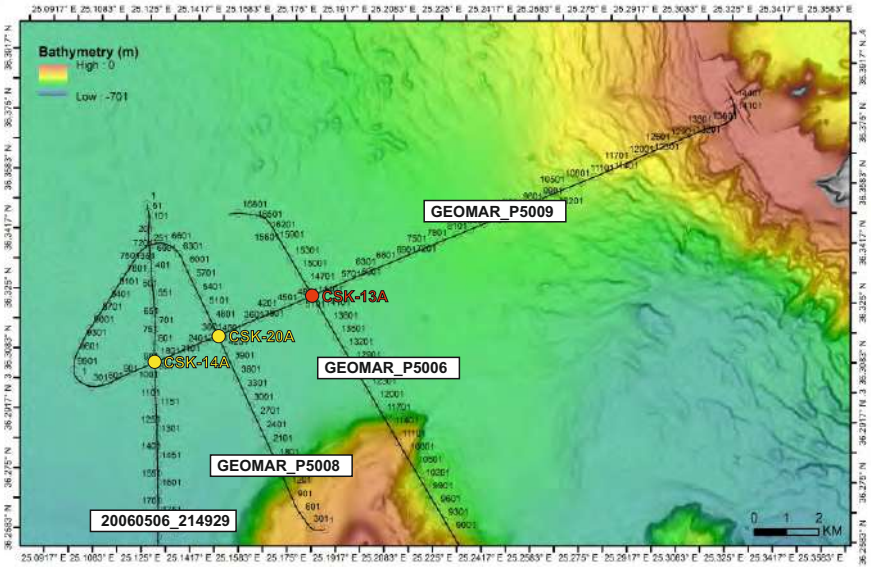
CSK-13A



CSK-13A: GEOMAR_P5009, CDP 5042 (a and c); GEOMAR_P5006, CDP 4431 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-13A_location.pdf
SEGY-data data: GEOMAR_P5009.sgy, GEOMAR_P5006.sgy
Navigation data: GEOMAR_P5009.txt, GEOMAR_P5006.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.3243/25.1826
Water depth: 489 m
Penetration: 857 m



Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile.

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-14A is sited in the Christiana Basin. This basin is deeper than the Anhydros and Anafi Basins, and is located SW of Santorini. Its volcano-sedimentary fill potentially records the earlier volcanic history of the CSK volcanic field (including the products of Christiana and early Santorini), as well as younger Santorini and possibly Milos Volcano. The hole will pass through alternating volcanic units, including volcaniclastics from Santorini (marine unitsTh1-3, with three possible pyroclastic flow deposits Pf1-3), and volcaniclastics from Christiana (Ch1, 2), to the pre-volcanic basement.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-14A	Area or Location:	Christiana Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.3049	Distance to Land: (km)	10
Longitude:	Deg: 25.1286		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ☑	Water Depth (m):	523

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	746	10
Total Sediment Thickness (m)	746	
Total Penetration (m):	756	

General Lithologies: Muds, volcaniclastics, debris flows, turbidites

Coring Plan: (Specify or check): 2 Holes APC/HLAPC to refusal, each followed by XCB to 675 mbsf; drill ahead in Hole C to 575 mbsf with the option of one or two cored RCB intervals of 50 meters in between and afterwards RCB to 756 mbsf, including 10 m pre volcanic basement; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 9.8 | Logging: 1.6 | Total On-site: 11.4

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-14A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: GEOMAR_P5009 Position: CDP 1644
1b High resolution seismic seismic reflection (crossing)	yes	Line: SBL20060506_214929-REPROC Position: CDP 886
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	~1m and ~3.5m long gravity cores (POS513/60 and 9), 6 km from site position showing a) coarse or hardened volcaniclastics after 1 meter of soft hemipelagic muds (Minoan eruption deposits) and b) homogenous hemipelagic muds with some 1 to 20 cm thick intercalated ash layers (max grain size= 2 mm) ; Sedimentation rate ~6 cm/ka in core POS513/9.
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	GEOMAR_P5009.txt, 20060506_214929-REPROC.txt
17 Other	no	

IODP Site Forms

Form 4 - Environmental Protection

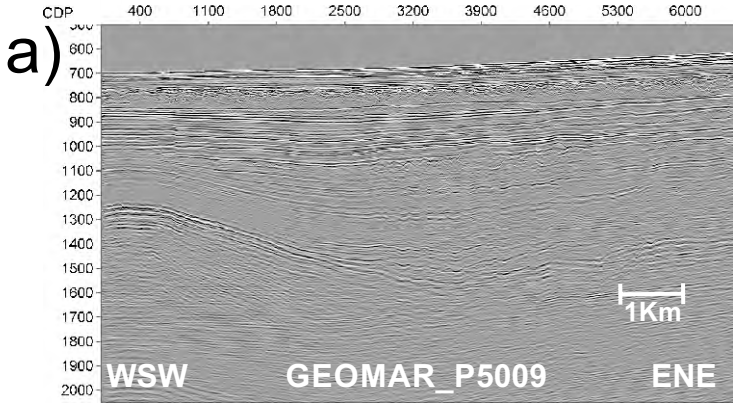
Proposal #: 932 - Add	Site #: CSK-14A	Date Form Submitted: 2019-11-22 13:07:02

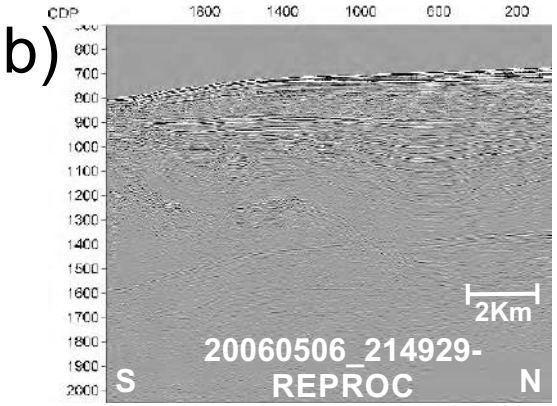
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to 675 mbsf; Hole C: RCB drilling ahead until 575 mbsf with the option of one or two cored intervals of 50 meters in between, RCB to 756 mbsf including 10 m of pre volcanic basement, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	coarser volcaniclastics from major eruptions

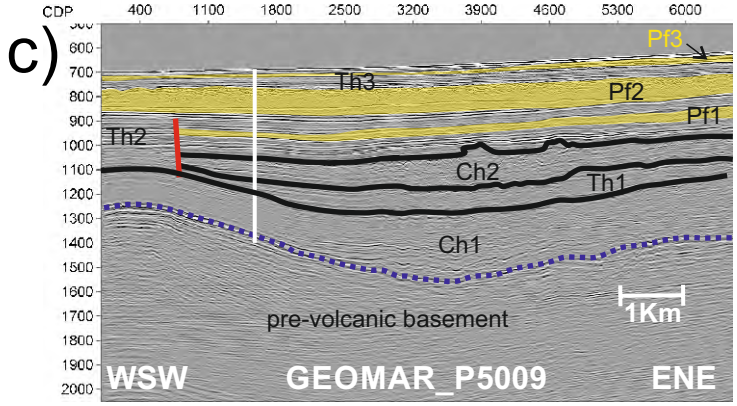
Proposal #: 932 - Add	Site #: CSK-14A	Date Form Submitted: 2019-11-22 13:07:02

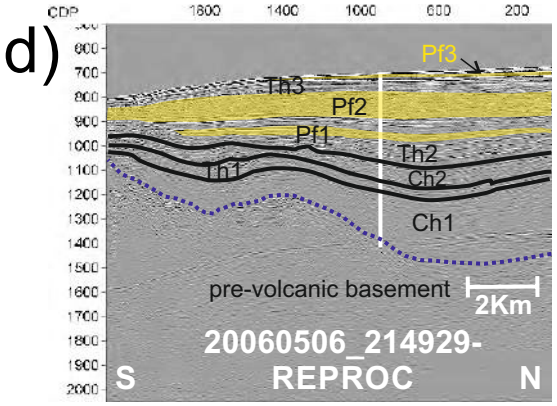
Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 7	Holocene background sedimentation with some volcanoclastics	<0.0036	1.6	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	3600	Based on interpretation of Tsampouraki-Kraounaki et al. (2018)
7 - 19	Late Bronze Age eruption, submarine pyroclastic flow deposit (Pf3)	0.0036	1.6	Pumiceous tuff, debris flows and thin overlying surface muds	filled marine basin	>1,000,000	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
19 - 70	Marine sedimentation (Th3) between pyroclastic flows Pf2 and Pf3	Pleistocene	1.7	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	130	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
70 - 161	Seismic unit Pf2, probable pyroclastic flow deposit from Santorini	Pleistocene; possibly 0.42 My	1.8	Pumiceous tuffs, debris flows	filled marine basin	>1,000,000	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
161 - 239	Marine sedimentation Th2 between seismic units Pf2 and Pf1, with volcaniclastics from Christiana, Santorini	Pleistocene/ Pliocene?	1.85	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	100	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
239 - 252	Possible pyroclastic flow deposit (Pf1)	Pleistocene/ Pliocene	1.9	Pumiceous tuffs, debris flows?	filled marine basin	>1,000,000	
252 - 338	Inter-fingering marine sedimentation and pyroclastic flow from Christiana (Ch2) and Pf1	Pliocene	1.95	hemipelagic muds, volcaniclastics, turbidites	rifted marine basin	80	
338 - 516	marine sedimentation and pyroclastic flow from Christiana (Ch2)	Pliocene	1.95	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	80	
516 - 746	Marine sedimentation (Th1) passing down into possible volcaniclastics from Christiana (Ch1)	Pliocene	2.0	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	80	
746 - 756	pre-volcanic basement	Mesozoic	3.0	limestone, schists, granites?	continental basement?	?	

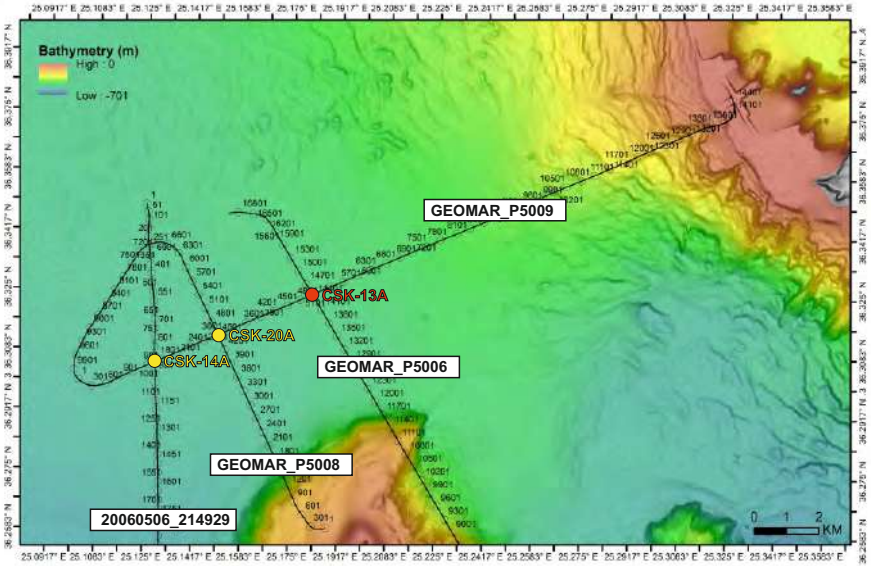
CSK-14A











CSK-14A: GEOMAR_P5009, CDP 1644 (a and c);
20060506_214929-REPROC, CDP 886 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-14A_location.pdf
SEGY-data data: GEOMAR_P5009.sgy,
20060506_214929-REPROC.sgy
Navigation data: GEOMAR_P5009.txt,
20060506_214929-REPROC.txt
Bathymetry: CSK_Bathymetry.grd,
CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd,
CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd,
CSK_Gravity_FreeAir.pdf
Gravity-Bouguer:
CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.3049/25.1286
Water depth: 523 m
Penetration: 756 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile.

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-15A targets the plio-quaternay volcano-sedimentary fill of the Anhydros Basin, to the depth of the Alpine basement. The site lies near the basin axis in a position downstream of Santorini and Kolumbo Volcanoes. The aim is to use the core (and seismic profiles) to reconstruct the volcanic, sedimentary and tectonic histories of the basin, and to access a near-continuous time series of volcanism in the area since rift inception. The hole will transect and characterize all six seismic packages of the Anhydros rift basin (B1 to B6).
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-15A	Area or Location:	Anhydros Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.7320	Distance to Land: (km)	10
Longitude:	Deg: 25.6463		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ☑	Water Depth (m):	490

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	790	10
Total Sediment Thickness (m)	790	
Total Penetration (m):	800	

General Lithologies: Muds, volcaniclastics, debris flows, turbidites | Limestone, schist or granite

Coring Plan: (Specify or check): 2 Holes APC/HLAPC to refusal, each followed by XCB to 610 mbsf; drill ahead in Hole C to 575 mbsf with the option of one or two cored intervals of 50 meters in between and afterwards RCB to 800 mbsf, including 10m of basement or until refusal; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 10.8 | Logging: 1.7 | Total On-site: 12.5

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas ☐	Complicated Seabed Condition ☐	Hydrothermal Activity ☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon ☐	Soft Seabed ☐	Landslide and Turbidity Current ☐	
Shallow Water Flow ☐	Currents ☐	Gas Hydrate ☐	
Abnormal Pressure ☐	Fracture Zone ☐	Diapir and Mud Volcano ☐	
Man-made Objects (e.g., sea-floor cables, dump sites) ☐	Fault ☐	High Temperature ☐	
H_2S ☐	High Dip Angle ☐	Ice Conditions ☐	
CO_2 ☐			

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-15A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: HH06-15-REPROC Position: CDP 2770
1b High resolution seismic seismic reflection (crossing)	no	No cross line
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	yes	See Velocity_Table.pdf
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	yes	The 3.5 kHz profiles do not run along the site survey profiles, but image the shallow strata on a regional scale.
7 Swath bathymetry	yes	CSK-bathy.grd, CSK-bathy.pdf
8a Side looking sonar (surface)	yes	
8b Side looking sonar (bottom)	no	
9 Photography or video		
10 Heat Flow		
11a Magnetics	yes	CSK-Mag.grd, CSL-Mag.pdf These grids cover entire study area on a regional scale, covering all sites. There are no site specific grids or maps.
11b Gravity	yes	CSK-Gravity-FreeAir.grd, CSK-Gravity-FreeAir.pdf CSK-Bouguer.grd, CSK-Gravity-FreeAir.pdf These grids cover entire study area on a regional scale, covering all sites. There are no site specific grids or maps.
12 Sediment cores	yes	~5m long gravity core and a box corer (POS513/15 and 21), 7.1 km from site position showing soft hemipelagic muds with some 1 to 5 cm thick intercalated ash layers; Sedimentation rate ~9 cm/ka.
13 Rock sampling		
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	HH06-15-REPROC.txt
17 Other	no	

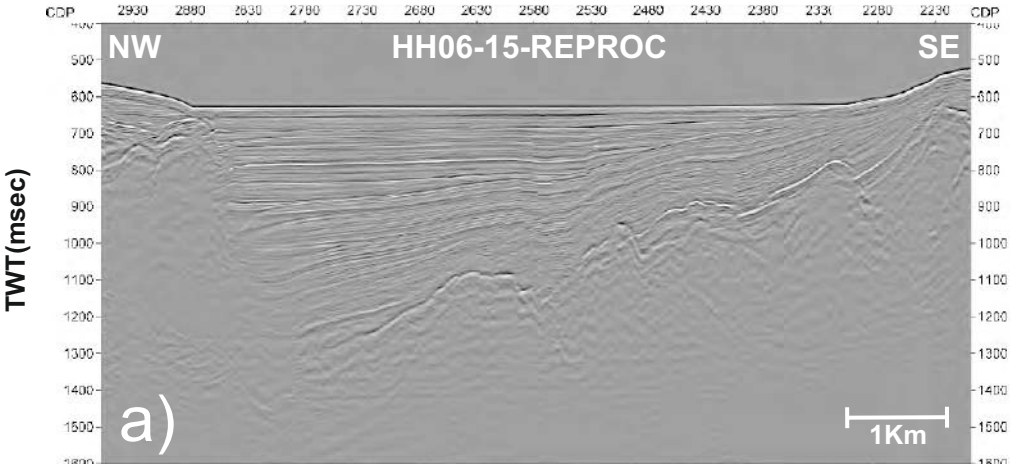
Proposal #: 932 - Add	Site #: CSK-15A	Date Form Submitted: 2019-11-22 13:07:02

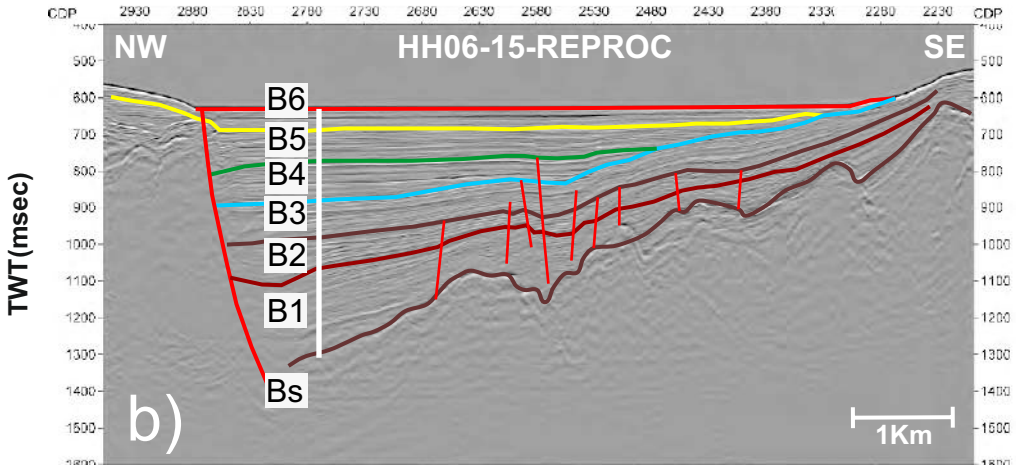
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to 610 mbsf; Hole C: RCB drilling ahead until 575 mbsf with the option of one or two cored intervals of 50 meters in between, RCB to 800 mbsf including 10 m of basement, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	no
5. Are there reasons to expect hydrocarbon accumulations at this site?	no
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	Non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	Target drill depth for XCB in Holes A and B may be to deep for XCB only but is covered by RCB in Hole C

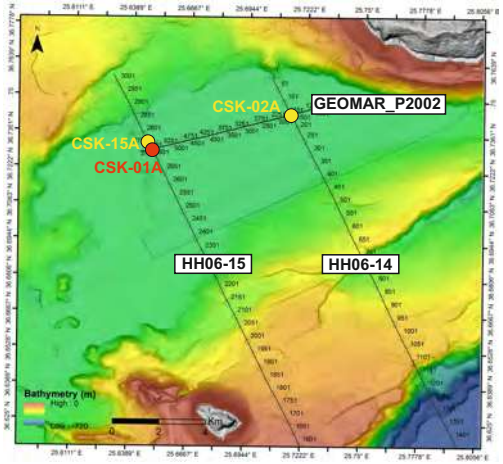
Proposal #: 932 - Add	Site #: CSK-15A	Date Form Submitted: 2019-11-22 13:07:02

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 43	Seismic unit B6: horizontal dipping beds, one stronger reflector at ~20 m	Pleistocene/ Holocene	1.6	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	180	lithology similar like in gravity core; interpretation Nomikou et al. (2016b; 2018)
43 - 95	Seismic unit B5: horizontal dipping beds	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	170	lithology and structures are the same like in first seismic units but stronger compacted; Interpretation after Nomikou et al. (2016b; 2018)
95 - 239	Seismic unit B4: horizontal dipping beds, several stronger reflectors distributed within the unit	Early? Pleistocene	2.0	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	160	More turbiditic deposits but at drill site still horizontal layering; interpretation after Nomikou et al. (2016b; 2018)
239 - 349	Seismic unit B3: subhorizontal dipping beds, several stronger reflectors distributed within the unit	Early Pleistocene/ Pliocene	2.1	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	150	Inclination in bedding indicate either initial fill off the rifted basin or tectonic activity; interpretation after Nomikou et al. (2016b; 2018)
349 - 488	Seismic unit B2: subhorizontal dipping beds, several stronger reflectors distributed within the unit; chaotic layering in the lower part?	early Pleistocene?/ Pliocene	2.4	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift	120	Inclination in bedding indicate either initial fill off the rifted basin or tectonic activity; chaotic layer may indicate slumping and mass flows; interpretation after Nomikou et al. (2016b; 2018)
488 - 790	Seismic unit B1: subhorizontal dipping beds on basement unconformity	Pliocene	2.6	MTD´s, sands and gravel, turbidites, hemipelagic muds, volcaniclastics	submarine to continental; initial filling of a rift basin	110	initial filling sequence of the rift with mixed volcaniclastic and continental material; interpretation after Nomikou et al. (2016b; 2018)
790 - 800	continental basement	Mesozoic	3.0	limestone, schists, granites	continental basement	??	Interpretation after Nomikou et al. (2016b; 2018)

CSK-15A







CSK-15A: HH06-15-REPROC, CDP 2770 (a and b)
Files to be uploaded to SSDB:
Location map: CSK-01A_location.pdf
SEGY-data: HH06-15-REPROC.sgy
Navigation data: HH06-15-REPROC.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf

Site Information:
Coordinates: 36.7320/25.6463
Water depth: 490 m
Penetration: 800 m

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-16A lies in the Anhydros Basin on the NW submarine flank of Kolumbo Volcano. The aim is to penetrate four seismically recognized volcanic eruption units from Kolumbo (K2, K3, K5 and the thin lateral continuation of K1), as well as many eruption units from Santorini. This will enable characterisation of the products of the Kolumbo eruptions, as well as construction of a coherent stratigraphy for Santorini and Kolumbo together.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-16A	Area or Location:	Anhydros Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.5480	Distance to Land: (km)	9
Longitude:	Deg: 25.4517		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ✓	Water Depth (m):	372

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	565	0
Total Sediment Thickness (m)	565	
Total Penetration (m):	565	

General Lithologies: Muds, volcaniclastics, debris flows, turbidites

Coring Plan: (Specify or check): 3 Holes APC/HLAPC to refusal, each followed by XCB to 565 mbsf; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☐ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 8.2 | Logging: 1.3 | Total On-site: 9.5

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas ☐	Complicated Seabed Condition ☐	Hydrothermal Activity ☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon ☐	Soft Seabed ☐	Landslide and Turbidity Current ☐	
Shallow Water Flow ☐	Currents ☐	Gas Hydrate ☐	
Abnormal Pressure ☐	Fracture Zone ☐	Diapir and Mud Volcano ☐	
Man-made Objects (e.g., sea-floor cables, dump sites) ☐	Fault ☐	High Temperature ☐	
H_2S ☐	High Dip Angle ☐	Ice Conditions ☐	
CO_2 ☐			

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-16A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: HH06-22-REPROC Position: CDP 722
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)		Data and info see Site CSK-01A
8b Side looking sonar (bottom)		
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	3 potential gravity cores nearby: POS513/57 3.5 km away showing 20 cm of muddy surface sediments and stuck in >30 cm fine to coarse ash volcaniclastics (63µ to 1 cm grain sizes); POS513/17 in 7.5 km distance showing 30 cm of muddy surface sediments and stuck in >50 cm fine grained volcaniclastics (<0.5 cm grain sizes); POS513/16 showing 20 cm of muddy surface sediments and stuck in 80 cm fine-grained volcaniclastics (<1mm grain size); Sedimentation rate ~9 cm/ka in muddy sediments, and event sedimentation for volcaniclastics.
13 Rock sampling		
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	HH06-22-REPROC.txt,
17 Other	no	

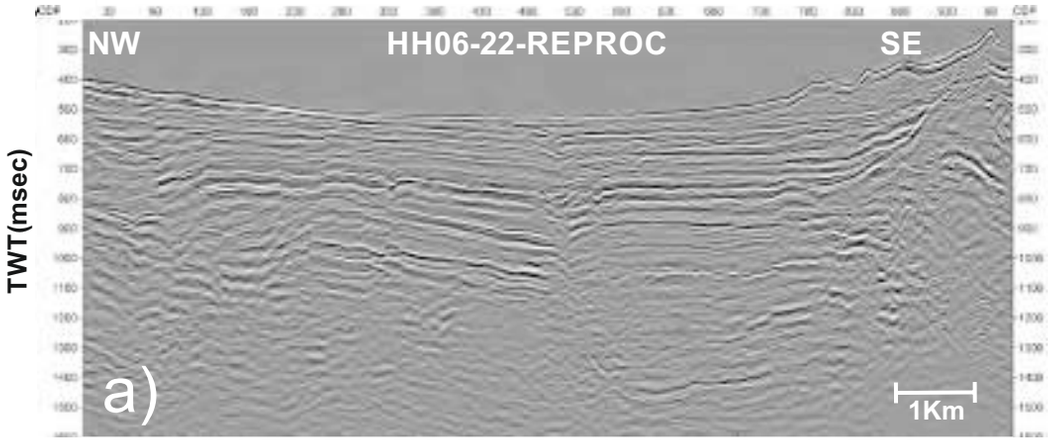
Proposal #: 932 - Add	Site #: CSK-16A	Date Form Submitted: 2019-11-22 13:07:02

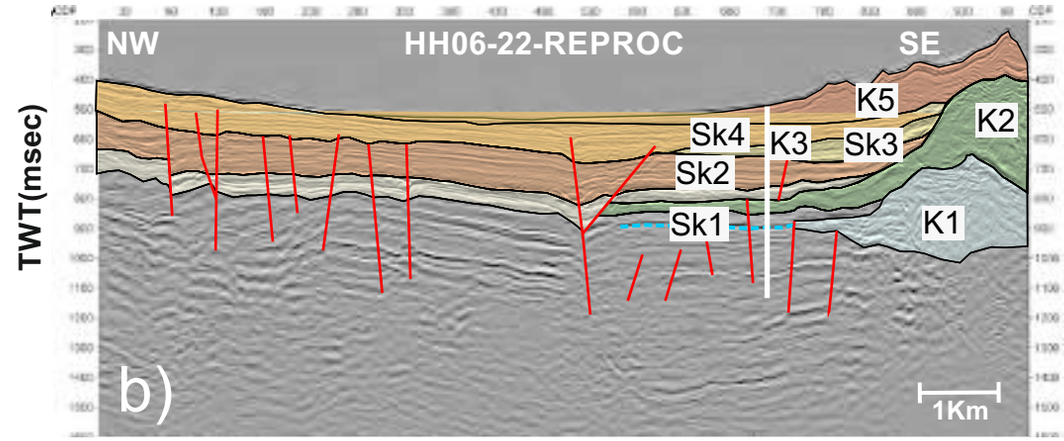
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Tripple APC/HLAPC (Holes A, B, C) to refusal including 4 temperature measurements, each followed by XCB to 565 mbsf or until refusal, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	Target drill depth may be to deep for XCB only and fine to coarse volcaniclastic in the top 10 meters may be be difficult to penetrate

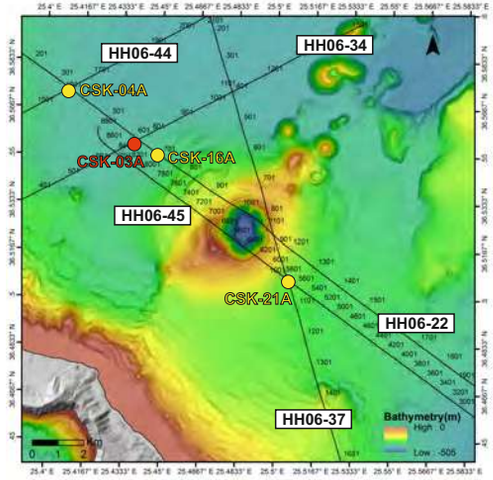
Proposal #: 932 - Add	Site #: CSK-16A	Date Form Submitted: 2019-11-22 13:07:02

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 20	Seismic unit K5: AD 1650 eruption of Kolumbo	AD 1650	1.65	Volcaniclastics (pumiceous)	filled submarine rift-basin	>1,000,000	Interpretation of Hubscher et al. (2015)
20 - 118	Seismic unit SK4; Volcaniclastics (including debris flows) from Santorini, and marine sedimentation	Holocene/ Upper Pleistocene	1.7	hemipelagic muds, volcaniclastics, turbidites, MTD´s	filled submarine rift-basin	130	Interpretation of Hubscher et al. (2015)
118 - 129	Seismic unit K3: eruption of Kolumbo	Pleistocene	1.75	volcaniclastics (probably pumiceous)	filled submarine rift-basin	>1,000,000	Interpretation of Hubscher et al. (2015)
129 - 212	Seismic unit SK3: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	120	Interpretation of Hubscher et al. (2015)
212 - 266	Seismic unit SK2: Volcaniclastics from Santorini (incuding mass flows) and marine sedimentation	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	110	Interpretation of Hubscher et al. (2015)
266 - 288	Seismic unit K2: eruption of Kolumbo	Pleistocene	1.85	volcaniclastics (probably pumiceous)	filled submarine rift-basin	>1,000,000	Interpretation of Hubscher et al. (2015)
288 - 311	Seismic unit SK1: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene	1.9	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	100	Interpretation of Hubscher et al. (2015)
311 - 320	Seismic unit K1: eruption of Kolumbo (intercalated within SK1)	Pleistocene	1.95	Volcaniclastics (probably pumiceous)	filled submarine rift-basin	>1,000,000	Presence of unit K1 extrapolated on seismic profiles and assumed to be <10 m thick; interpretation of Hubscher et al. (2015)
320 - 565	Seismic unit pre-K1: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene/ Pliocene?	1900	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	80	Interpretation of Hubscher et al. (2015)

CSK-16A







CSK-16A: HH06-22-REPROC, CDP 722 (a and b);

Site information:
Coordinates:36.5480/25.4517
Water depth: 372 m
Penetration: 565 m

Files to be uploaded to SSDB:
Location map: CSK-04A_location.pdf
SEGY-data data: HH06-22-REPROC.sgy
Navigation data: HH06-22-REPROC.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-17A is sited in the northern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them and confirm (or not) published hypotheses, as well as to penetrate below unit S3 (probably intracaldera tuff of the LBA eruption). The hole is located north of a low-velocity seismic anomaly detected by the PROTEUS seismic tomography experiments and centered on the focus of caldera floor uplift during the unrest period of 2011-12.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini. Onland drilling on Kameni islands to 200 m depth in 1987-88.

Section B: General Site Information

Site Name:	CSK-17A	Area or Location:	Santorini caldera (northern basin), Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.4339	Distance to Land: (km)	2
Longitude:	Deg: 25.3819		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ☑	Water Depth (m):	386

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	420	0
Total Sediment Thickness (m)	420	
Total Penetration (m):	420	

General Lithologies: Coarse intracaldera sediments, breccias, landslides, lavas, muds

Coring Plan: (Specify or check): 2 Holes APC/HLAPC/XCB to refusal, drill ahead in Hole C to 150 mbsf and RCB to 420 mbsf; wirleline logging in Hole D (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 4.8 | Logging: 1 | Total On-site: 5.8

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping. Multiple cruise liners in the summer months. No bright spots indicative of gas to the 400 mbsf on available seismic profiles.

Proposal #: 932 - Add	Site #: CSK-17A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: GEOMAR_P1006 Position: CDP 19938
1b High resolution seismic seismic reflection (crossing)	no	
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	Mostly Box corer from 2006 R/V Aegeao expedition of variable length up to 1 m. Mixture of hemipelagic muds and volcaniclastics
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	GEOMAR_P1006.txt
17 Other	no	

IODP Site Forms

Form 4 - Environmental Protection

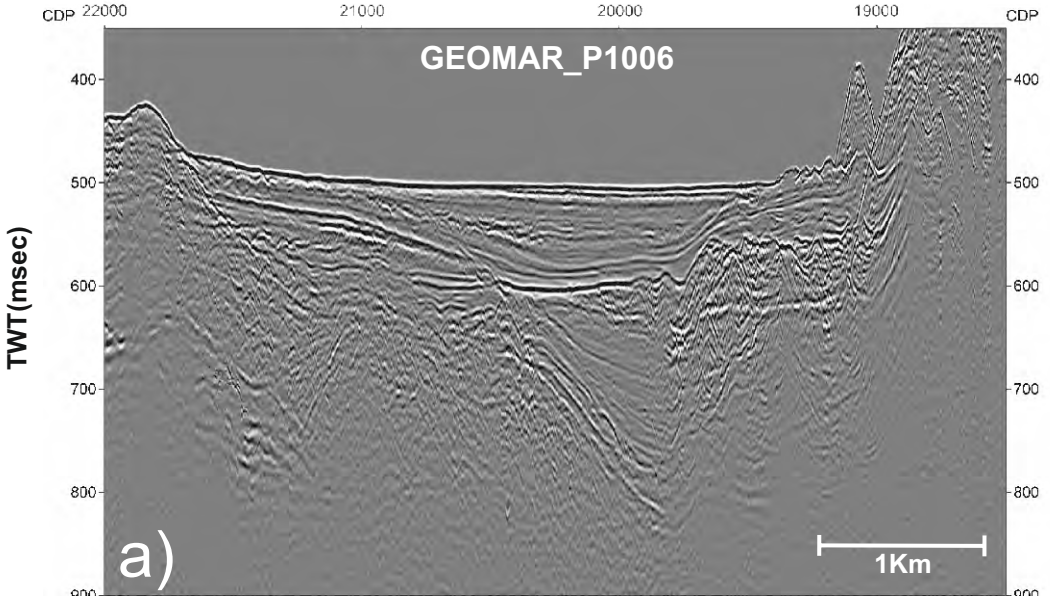
Proposal #: 932 - Add	Site #: CSK-17A	Date Form Submitted: 2019-11-22 13:07:02

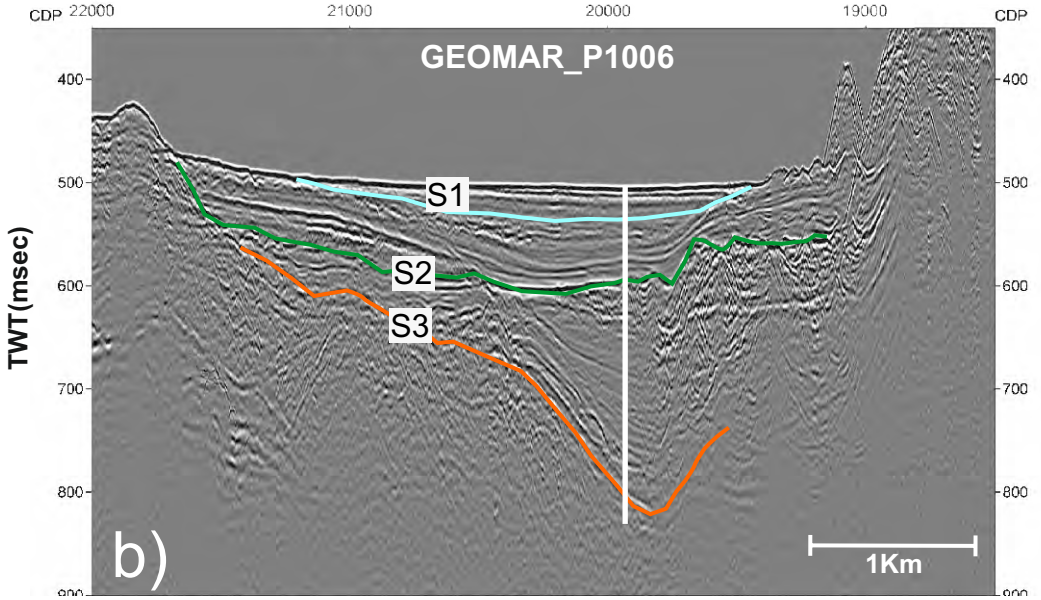
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to refusal; Hole C: RCB drilling ahead until 150 mbsf, RCB to 420 mbsf, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	heavy ship traffic in the Caldera but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	coarse clastics and lava blocks

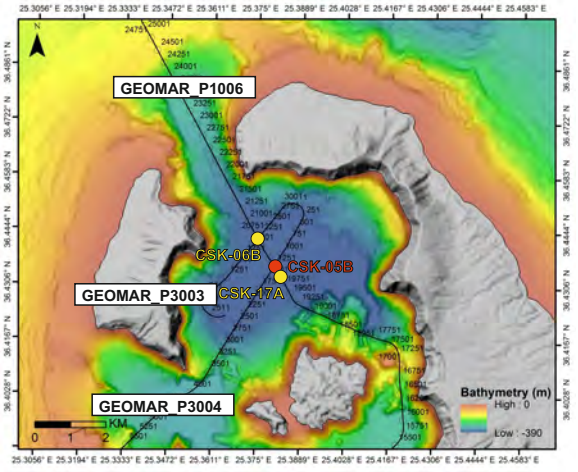
Proposal #: 932 - Add	Site #: CSK-17A	Date Form Submitted: 2019-11-22 13:07:02

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 30	Seismic unit S1; subaerial eruptions and mass wasting of caldera cliffs	<0.0020	1.6	volcaniclastics, turbidites, debris flows, muds	Intra caldera fill	15,000	Interpretation from Johnston et al. (2015)
30 - 88	Seismic unit S2; mainly submarine eruptions of Kameni Volcano	0.0036 to 0.0020	1.8	volcaniclastics, muds	Intra-caldera fill	35,000	Interpretation from Johnston et al. (2015)
88 - 186	Seismic unit S3: end of LBA eruption; caldera flooding	0.0036	1.9	coarse gravels, tuffs, debris avalanches, debris flows	Intra-caldera fill	>1,000,000	Interpretation from Johnston et al. (2015) and Nomikou et al. (2016a)
186 - 420	Pre-S3: Late Bronze Age eruption (top of intracaldera tuffs)	3600 years	2.0	Blocky unwelded tuffs, with possible welded layers and lavas	Intra-caldera fill	>1,000,000	Interpretation of Johnston et al. (2015) and Nomikou et al. (2016a)

CSK-17A







CSK-17A: GEOMAR_P1006, CDP 19938 (a and b)

Location map: CSK-05B_location.pdf
SEGY-data data: GEOMAR_P1006.sgy
Navigation data: GEOMAR_P1006.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.4339/25.3819
Water depth: 386 m
Penetration: 420 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-18A is sited in the southern basin of Santorini caldera. The aim is to penetrate intracaldera seismic units S1, S2, and S3 in order to characterise them, as well as to penetrate below unit S3 (probable intracaldera tuff of the LBA eruption). This site is complementary to sites in the northern caldera basin, as together they will provide a complete understanding of the caldera fill and collapse history.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini. Onland drilling on Kameni islands to 200 m depth in 1987-88.

Section B: General Site Information

Site Name:	CSK-18A	Area or Location:	Santorini caldera (southern basin), Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.3755	Distance to Land: (km)	1
Longitude:	Deg: 25.3942		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ☑	Water Depth (m):	291

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Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	380	0
Total Sediment Thickness (m)	380	
Total Penetration (m):	380	

General Lithologies: Coarse intracaldera sediments, breccias, landslides, lavas, muds

Coring Plan: (Specify or check): 2 Holes APC/HLAPC/XCB to refusal; drill ahead to 175 mbsf and RCB to 380 mbsf; wirleline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 4.5 | Logging: 1 | Total On-site: 5.5

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping. Multiple cruise liners in the summer months. No bright spots indicative of gas on seismic profiles.

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-18A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: GEOMAR_P1006 Position: CDP 13690
1b High resolution seismic seismic reflection (crossing)	yes	Line: SBL20060429_134104-REPROC Position: CDP 1845
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	Mostly Box corer from 2006 R/V Aegeao expedition of variable length up to 1 m. Mixture of hemipelagic muds and volcaniclastics
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	GEOMAR_P1006.txt, 20060429_134104-REPROC.txt
17 Other	no	

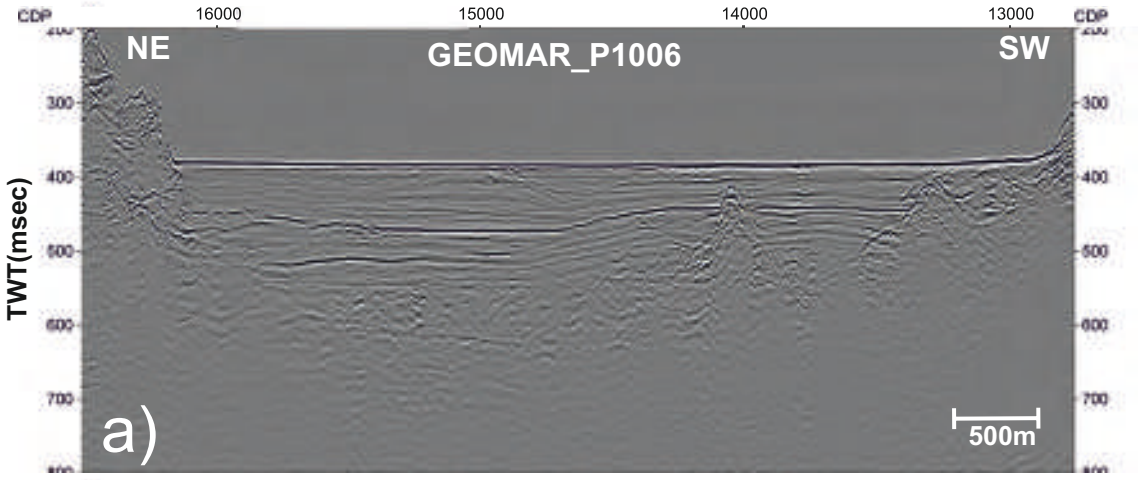
Proposal #: 932 - Add	Site #: CSK-18A	Date Form Submitted: 2019-11-22 13:07:02

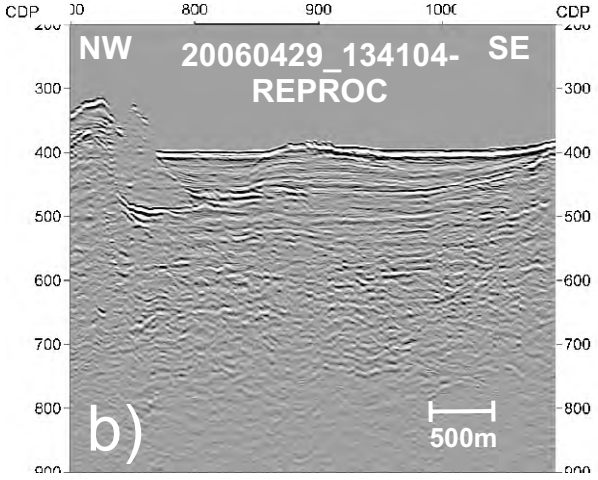
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to refusal; Hole C: RCB drilling ahead until 175 mbsf, RCB to 380 mbsf, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	heavy ship traffic in the Caldera but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	coarse clastics and lava blocks

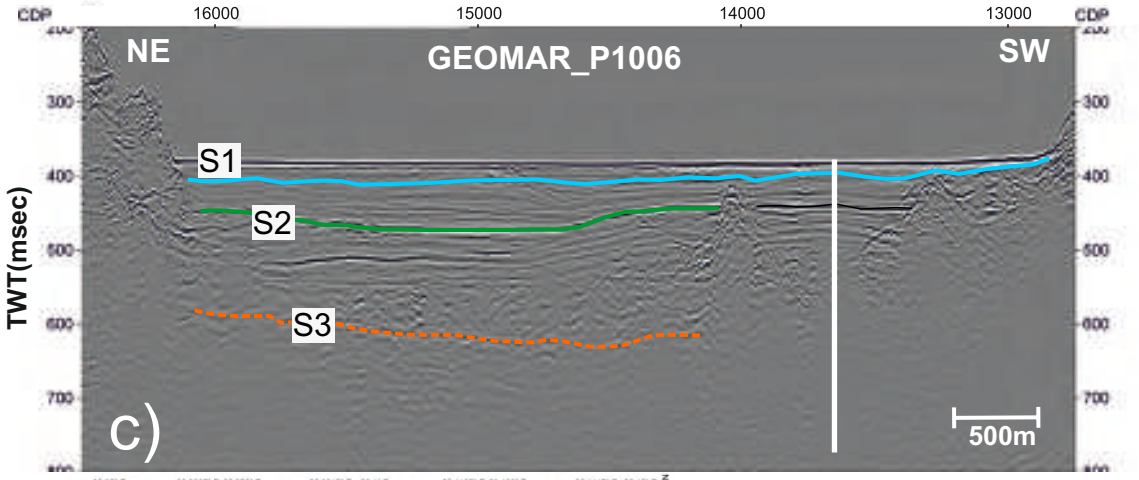
Proposal #: 932 - Add	Site #: CSK-18A	Date Form Submitted: 2019-11-22 13:07:02

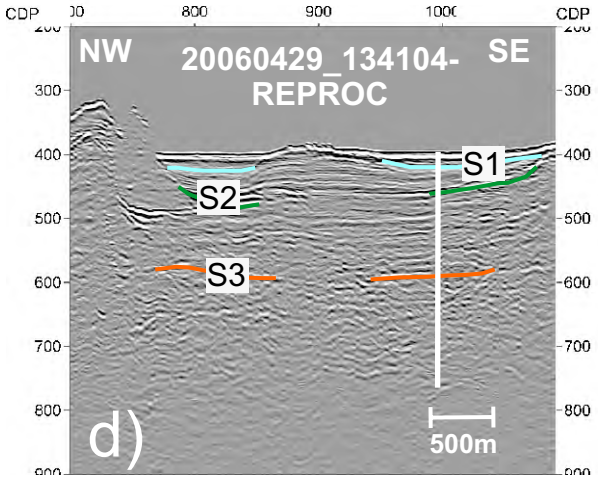
Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 20	Seismic unit S1: subaerial eruptions and mass wasting of the caldera cliffs	<0.0020	1.6	volcaniclastics, turbidites, debris flows, muds	intra caldera fill	10,000	Interpretation from Johnston et al. (2015)
20 - 77	Seismic unit S2: mainly submarine eruptions of Kameni Volcano	0.0036 to 0.0020	1.8	volcaniclastics, muds	Intra-caldera fill	36,000	Interpretation from Johnston et al. (2015)
77 - 218	Seismic unit S3: end of LBA eruption; caldera flooding	0.0036	1.9	Coarse gravels, tuffs, debris avalanches, debris flows	Intra-caldera fill	>1,000,000	Interpretation from Johnston et al. (2015) and Nomikou et al. (2016a)
218 - 380	Sub-S3: Late Bronze Age eruption (top of intracaldera tuffs)	0.0036	2.0	Blocky unwelded tuffs, with possible welded layers and lavas	Intra-caldera fill	>1,000,000	Interpretation of Johnston et al. (2015)

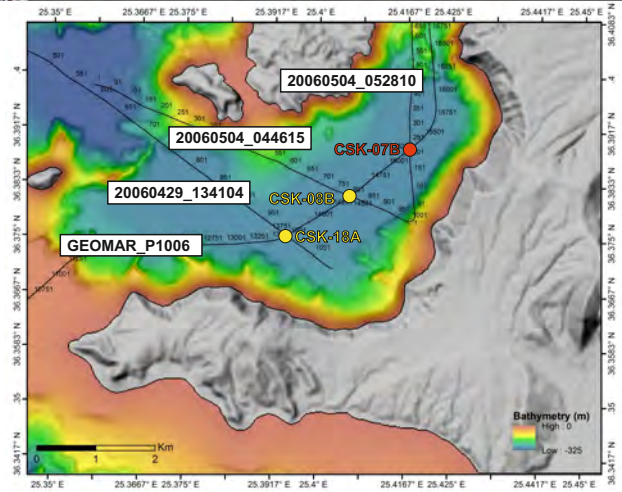
CSK-18A











CSK-18A: GEOMAR_P1006, CDP 13690 (a and c); 20060429_134104-REPROC, CDP 1845 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-08B_location.pdf
SEGY-data data: GEOMAR_P1006.sgy, 20060429_134104-REPROC.sgy
Navigation data: GEOMAR_P1006.txt, 20060429_134104-REPROC.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.3755/25.3942
Water depth: 291 m
Penetration: 380 m

Additional data available:
Magnetic: CSK_Magnetic.grd, CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-19A is sited in the Anafi Basin. The aim is to penetrate the entire volcano-sedimentary fill of this basin as far as the Alpine basement. The basin potentially records the full volcanic history of Santorini (and any older centres) since rift inception, but not of Kolumbo Volcano. The hole will reconstruct the subsidence and sedimentary history of this basin, to compare with that of the Anhydros Basin. It will transect all six seismic units present in the basin (B1 to B6).
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-19A	Area or Location:	Anafi Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.5563	Distance to Land: (km)	9
Longitude:	Deg: 25.7503		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ✓	Water Depth (m):	688

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	730	10
Total Sediment Thickness (m)	730	
Total Penetration (m):	740	

General Lithologies:	Muds, volcaniclastics, debris flows, turbidites / Limestone, schist or granite
Coring Plan: (Specify or check)	2 Holes APC/HLAPC to refusal, each followed by XCB to 610 mbsf; drill ahead in Hole C to 575 mbsf with the option of one or two cored intervals of 50 meters in between and afterwards RCB to 740 mbsf, including 10 m basement or until refusal; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☐ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days:	Drilling/Coring: 9.8	Logging: 1.6	Total On-site: 11.4

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping

Proposal #: 932 - Add	Site #: CSK-19A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: HH06-04-REPROC Position: CDP 1919
1b High resolution seismic seismic reflection (crossing)	yes	Line: GEOMAR_P5017 Position: CDP 1298
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	yes	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	yes	~2m long gravity core (POS513/20), 7.8 km from site position showing soft hemipelagic muds with carbonate clasts, some cm thick intercalated ash layers and two dm-scaled tephra layers unto coarse ash and fine lapilli (up to 1 cm); Sedimentation rate ~9 cm/ka.
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	HH06-15-REPROC.txt, GEOMAR_P5017.txt
17 Other	no	

IODP Site Forms

Form 4 - Environmental Protection

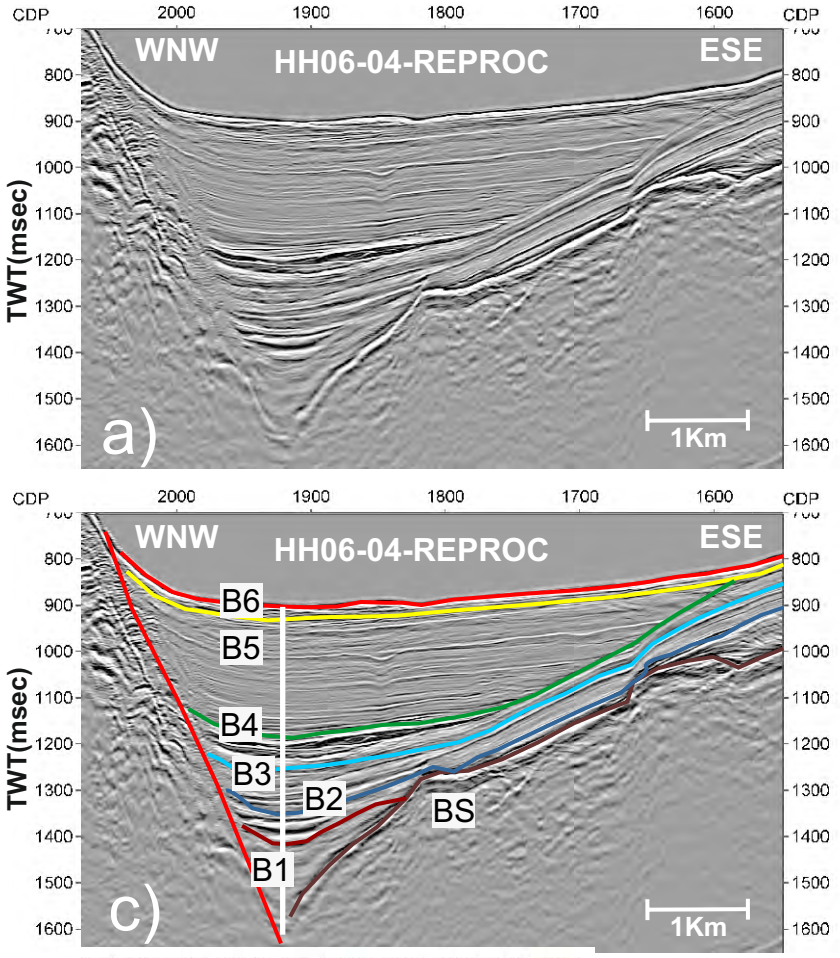
Proposal #: 932 - Add	Site #: CSK-19A	Date Form Submitted: 2019-11-22 13:07:02

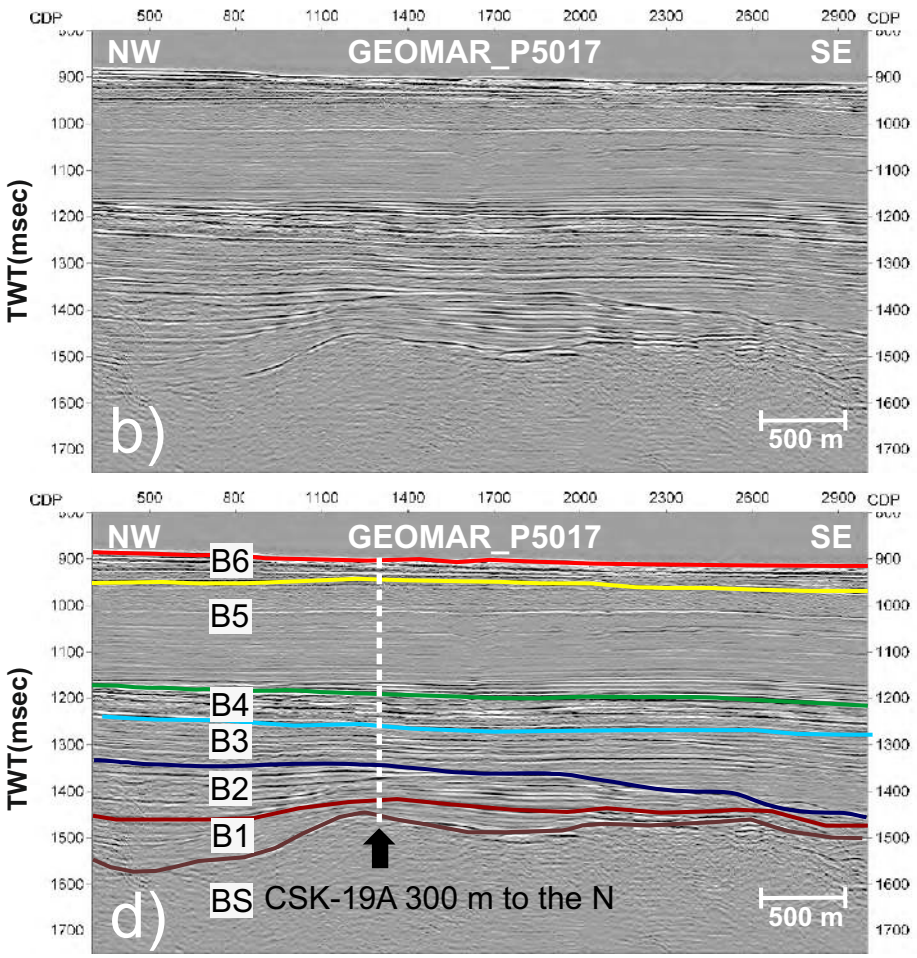
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to 610 mbsf; Hole C: RCB drilling ahead until 575 mbsf with the option of one or two cored intervals of 50 meters in between, RCB to 740 mbsf including 10 m of basement, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	no
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	Target drill depth for XCB in Holes A and B may be to deep for XCB only but is covered by RCB in Hole C

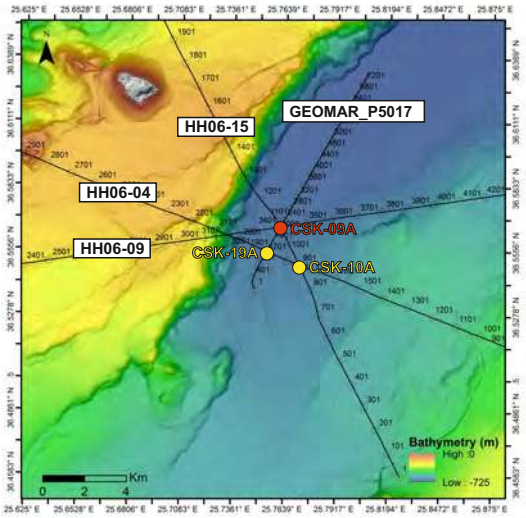
Proposal #: 932 - Add	Site #: CSK-19A	Date Form Submitted: 2019-11-22 13:07:02

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 37	Seismic unit B6: horizontal dipping beds and unconformity into B5	Pleistocene/ Holocene	1.6	hemipelagic muds, volcaniclastics, turbidites	filled submarine rift-basin	140	lithology similar like in gravity core; interpretation after Nomikou et al. (2018)
37 - 260	Seismic unit B5: subhorizontal dipping beds, several stronger reflectors distributed within the unit; chaotic layering in the upper part?	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	130	chaotic layering implicate kind of mass transport deposits and high sedimentation rate due to tectonics?; interpretation after Nomikou et al. (2018)
260 - 323	Seismic unit B4 with subhorizontal dipping beds, several stronger reflectors distributed within the unit	Early? Pleistocene	2.0	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	120	More turbiditic deposits and subhorizontal layering, tectonics? Interpretation Nomikou et al. (2018)
323 - 381	Seismic unit B3. Subhorizontal bedding, chaotic layer, MTD? Unconformity onto steep layered unit B2.	Early Pleistocene/ Pliocene	2.1	hemipelagic muds, volcaniclastics, turbidites, MTD´s?	filled submarine rift-basin	120	Chaotic layering implicates mass transport deposits and high sedimentation rate due to tectonics? Interpretation Nomikou et al. (2018)
381 - 512	Seismic unit B2	early Pleistocene?/ Pliocene	2.4	turbidites, hemipelagics, volcaniclastics, MTD´s	filled submarine rift-basin	120	steep bedding assumes tectonics after initial fill. Interpretation Nomikou et al. (2018)
512 - 730	Seismic unit B1; unconformity into continental basement	Pliocene	2.6	MTD´s, sands and gravel, turbidites, hemipelagic muds, volcaniclastics	submarine to continental; initial filling of a rift basin	110	initial filling sequence of the rift with mixed volcaniclastic and continental material. Interpretation Nomikou et al. (2018)
730 - 740	continental basement	Mesozoic	3.0	limestone, shists, granites	continental basement	??	

CSK-19A







CSK-19A: HH06-04-REPROC, CDP 1919 (a and c); GEOMAR_P5017, CDP 1298 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-09A-10A_location.pdf
SEGY-data data: HH06-15-REPROC.sgy, GEOMAR_P5017.sgy
Navigation data: HH06-15-REPROC.txt, GEOMAR_P5017.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.5563/25.7503
Water depth: 688 m
Penetration: 740 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-20A is sited in the Christiana Basin. This basin is deeper than the Anhydros and Anafi Basins, and is located SW of Santorini. Its volcano-sedimentary fill potentially records the earlier volcanic history of the CSK volcanic field (including the products of Christiana and early Santorini), as well as younger Santorini and possibly Milos Volcano. The hole will pass through alternating volcanic units, including volcaniclastics from Santorini (marine units Th1-3, with three possible pyroclastic flow deposits Pf1-3), and volcaniclastics from Christiana (Ch1, 2), to the pre-volcanic basement.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini

Section B: General Site Information

Site Name:	CSK-20A	Area or Location:	Christiana Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial waters
Latitude:	Deg: 36.3127	Distance to Land: (km)	10
Longitude:	Deg: 25.1501		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ☑	Water Depth (m):	515

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	899	10
Total Sediment Thickness (m)	899	
Total Penetration (m):	909	

General Lithologies: Muds, volcaniclastics, debris flows, turbidites

Coring Plan: (Specify or check): 2 Holes APC/HLAPC to refusal, each followed by XCB to 675 mbsf; drill ahead in Hole C to 575 mbsf with the option of one or two cored RCB intervals of 50 meters in between and afterwards RCB to 909 mbsf, including 10 m of pre volcanic basement; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 10.5 | Logging: 1.9 | Total On-site: 12.4

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-20A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: GEOMAR_P5009 Position: CDP 3013
1b High resolution seismic seismic reflection (crossing)	yes	Line: GEOMAR_P5008 Position: CDP 4521 Not available yet
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	Data and info see Site CSK-01A
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	no	~1m and ~3.5m long gravity cores (POS513/60 and 9), 3.8 km and 8 km from site position showing a) coarse or hardened volcaniclastics after 1 meter of soft hemipelagic muds (Minoan eruption deposits) and b) homogenous hemipelagic muds with some 1 to 20 cm thick intercalated ash layers (max grain size= 2 mm) ; Sedimentation rate ~6 cm/ka in core POS513/9.
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	GEOMAR_P5009.txt, GEOMAR_P5008.txt
17 Other	no	

IODP Site Forms

Form 4 - Environmental Protection

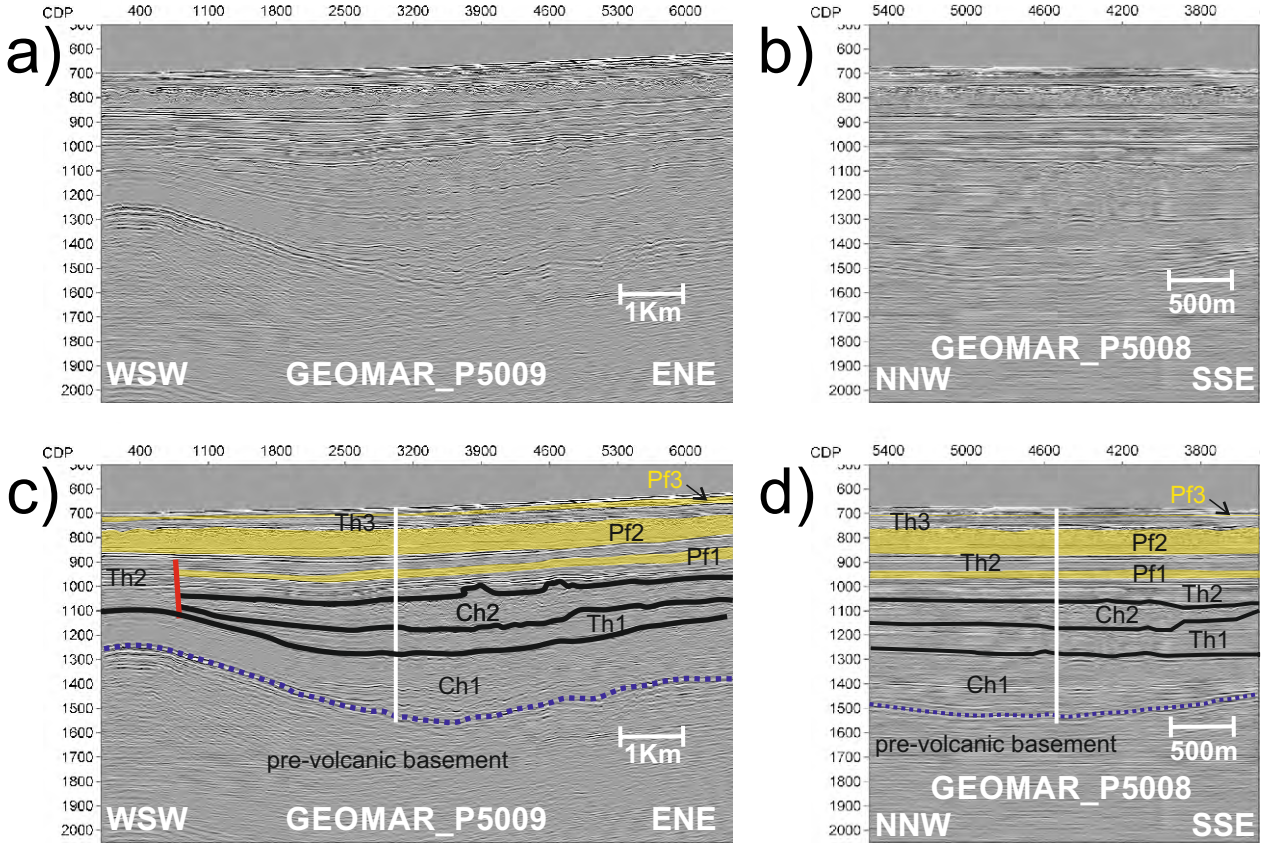
Proposal #: 932 - Add	Site #: CSK-20A	Date Form Submitted: 2019-11-22 13:07:02

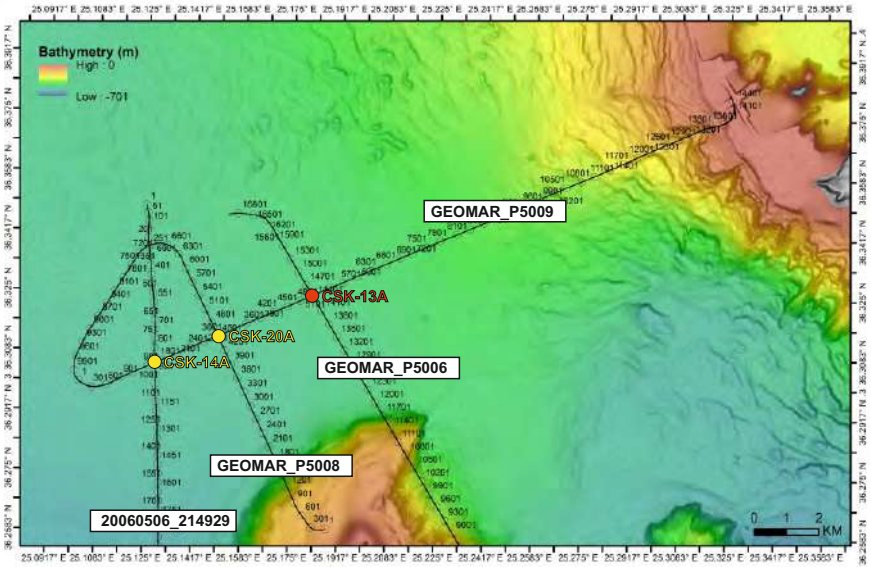
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to 675 mbsf; Hole C: RCB drilling ahead until 575 mbsf with the option of one or two cored intervals of 50 meters in between, RCB to 909 mbsf including 10 m of basement, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	coarser volcaniclastics from major eruptions

Proposal #: 932 - Add	Site #: CSK-20A	Date Form Submitted: 2019-11-22 13:07:02

Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 7	Holocene background sedimentation with some volcanoclastics	<0.0036	1.6	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	3600	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
7 - 19	Late Bronze Age eruption, submarine pyroclastic flow deposit (PF 3)	0.0036	1.65	Pumiceous tuffs, debris flows and thin overlying surface muds	filled marine basin	>1,000,000	Based on interpretation of Tsampouraki-Kraounaki et al. (2018)
19 - 80	Marine sedimentation (Th3) between pyroclastic flows Pf2 and Pf3	Pleistocene	1.7	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	130	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
80 - 170	Seismic unit Pf2, probable pyroclastic flow deposit from Santorini	Pleistocene; possibly 0.42 My	1.8	Pumiceous tuffs, debris flows	filled marine basin	>1,000,000	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
170 - 237	Marine sedimentation Th2 between seismic units Pf2 and PF1, with volcaniclastics from Christiana, Santorini	Pleistocene/ Pliocene?	1.85	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	100	Based on interpretation of Tsampouraki-Kraounaki et al. (2018).
237 - 258	Possible pyroclastic flow deposit (Pf1)	Pleistocene/ Pliocene	1.9	Pumiceous tuffs, debris flows?	filled marine basin	>1,000,000	
258 - 350	Inter-fingering marine sedimentation and pyroclastic flow from Christiana (Ch2) and Pf1	Pliocene	1.95	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	80	
350 - 548	marine sedimentation and pyroclastic flow from Christiana (Ch2)	Pliocene	1.95	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	80	
548 - 899	Marine sedimentation (Th1) passing down into possible volcaniclastics from Christiana (Ch1)	Pliocene	2.0	hemipelagic muds, volcaniclastics, turbidites	filled marine basin	80	
899 - 909	pre-volcanic basement	Mesozoic	3.0	limestone, schists, granites?	continental basement?	?	

CSK-20A





CSK-20A: GEOMAR_P5009, CDP 3013 (a and c); GEOMAR_P5008, CDP 4521 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-20A_location.pdf
SEGY-data data: GEOMAR_P5009.sgy, GEOMAR_P5008.sgy
Navigation data: GEOMAR_P5009.txt, GEOMAR_P5008.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates: 36.3127/25.1501
Water depth: 515 m
Penetration: 909 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile.

IODP Site Forms

Form 1 – General Site Information

932 - Add

Section A: Proposal Information

Proposal Title	Volcanism and tectonics in an island-arc rift environment (VolTecArc): Christiana-Santorini-Kolumbo marine volcanic field, Greece
Date Form Submitted	2019-11-22 13:07:02
Site-Specific Objectives with Priority (Must include general objectives in proposal)	CSK-21A lies in the Anhydros Basin on the SE submarine flank of Kolumbo Seamount Volcano. The aim is to penetrate seismically recognized volcanic eruption units from Kolumbo (K1, K3, K5), as well as many units from Santorini. This will enable characterisation of the products of the Kolumbo eruptions, as well as construction of a coherent stratigraphy for Santorini and Kolumbo together.
List Previous Drilling in Area	DSDP hole 378 was drilled in 1975 in the Cretan basin 60 km SSW of Santorini.

Section B: General Site Information

Site Name:	CSK-21A	Area or Location:	Anhydros Basin, Aegean Sea, Greece
If site is a reoccupation of an old DSDP/ODP Site, Please include former Site#		Jurisdiction:	Greek territorial water
Latitude:	Deg: 36.5068	Distance to Land: (km)	8
Longitude:	Deg: 25.5053		
Coordinate System:	WGS 84		
Priority of Site:	Primary: ☐ Alternate: ☑	Water Depth (m):	309

Section C: Operational Information

	Sediments	Basement
Proposed Penetration (m):	730	0
Total Sediment Thickness (m)	730	
Total Penetration (m):	730	

General Lithologies: Muds, volcaniclastics, debris flows, turbidites

Coring Plan: (Specify or check): 2 Holes APC/HLAPC to refusal, each followed by XCB to 610 mbsf; drill ahead in Hole C to 575 mbsf with the option of one or two cored RCB intervals of 50 meters in between and afterwards RCB to 730 mbsf; wireline logging in Hole C (Tripple Combo, FMS Sonic, VSI)

APC ☑ XCB ☑ RCB ☑ Re-entry ☐ PCS ☐

Wireline Logging Plan:

Standard Measurements		Special Tools		
WL	☑	Magnetic Susceptibility	☑	Other tools:
Porosity	☑	Borehole Temperature	☑	
Density	☑	Formation Image (Acoustic)	☐	
Gamma Ray	☑	VSP (walkaway)	☐	
Resistivity	☑	LWD	☐	
Sonic (Δt)	☑			
Formation Image (Res)	☑			
VSP (zero offset)	☑			
Formation Temperature & Pressure	☐			

Other Measurements:

Estimated Days: Drilling/Coring: 10.4 | Logging: 1.5 | Total On-site: 11.9

Observatory Plan: *Longterm Borehole Observation Plan/Re-entry Plan*

Potential Hazards/ Weather:

Shallow Gas	☐	Complicated Seabed Condition	☐	Hydrothermal Activity	☐	Preferred weather window: Late autumn, winter or early spring
Hydrocarbon	☐	Soft Seabed	☐	Landslide and Turbidity Current	☐	
Shallow Water Flow	☐	Currents	☐	Gas Hydrate	☐	
Abnormal Pressure	☐	Fracture Zone	☐	Diapir and Mud Volcano	☐	
Man-made Objects (e.g., sea-floor cables, dump sites)	☐	Fault	☐	High Temperature	☐	
H_2S	☐	High Dip Angle	☐	Ice Conditions	☐	
CO_2	☐					

Sensitive marine habitat (e.g., reefs, vents):

Other: High winds, dense tourist shipping

IODP Site Forms

Form 2 - Site Survey Detail

Proposal #: 932 - Add	Site #: CSK-21A	Date Form Submitted: 2019-11-22 13:07:02

Data Type	In SSDB	Details of available data and data that are still to be collected
1a High resolution seismic reflection (primary)	yes	Line: HH06-37-REPROC Position: CDP 1009
1b High resolution seismic seismic reflection (crossing)	yes	Line: HH06-45-REPROC Position: CDP 5727
2a Deep penetration seismic reflection (primary)	no	
2b Deep penetration seismic reflection (crossing)	no	
3 Seismic Velocity	no	Data and info see Site CSK-01A
4 Seismic Grid	no	
5a Refraction (surface)	no	
5b Refraction (bottom)	no	
6 3.5 kHz	no	Data and info see Site CSK-01A
7 Swath bathymetry	no	Data and info see Site CSK-01A
8a Side looking sonar (surface)	no	
8b Side looking sonar (bottom)	no	
9 Photography or video	no	
10 Heat Flow	no	
11a Magnetics	no	Data and info see Site CSK-01A
11b Gravity	no	Data and info see Site CSK-01A
12 Sediment cores	no	~1m long gravity core (POS513/19), 9 km from site position showing hemipelagic muds and > 50 cm thick ash and pumice layer (max grain size= 40 mm); Sedimentation rate ~5 cm/ka .
13 Rock sampling	no	
14a Water current data	no	
14b Ice Conditions	no	
15 OBS microseismicity	no	
16 Navigation	yes	HH06-37-REPROC.txt, HH06-45-REPROC.txt
17 Other	no	

IODP Site Forms

Form 4 - Environmental Protection

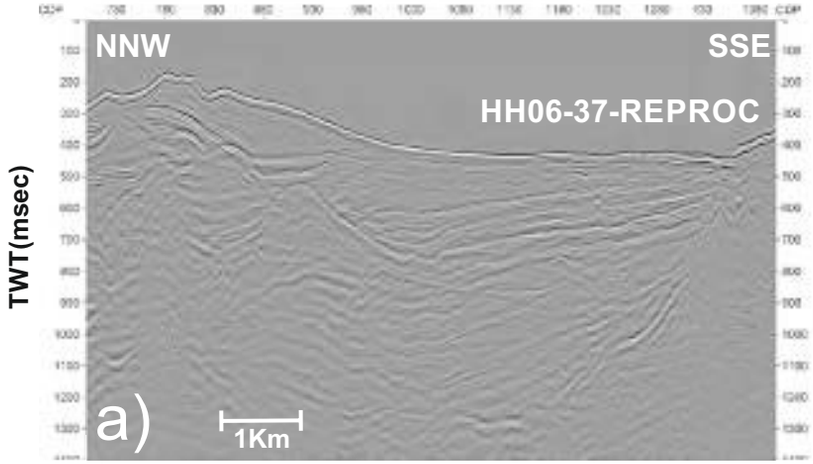
Proposal #: 932 - Add	Site #: CSK-21A	Date Form Submitted: 2019-11-22 13:07:02

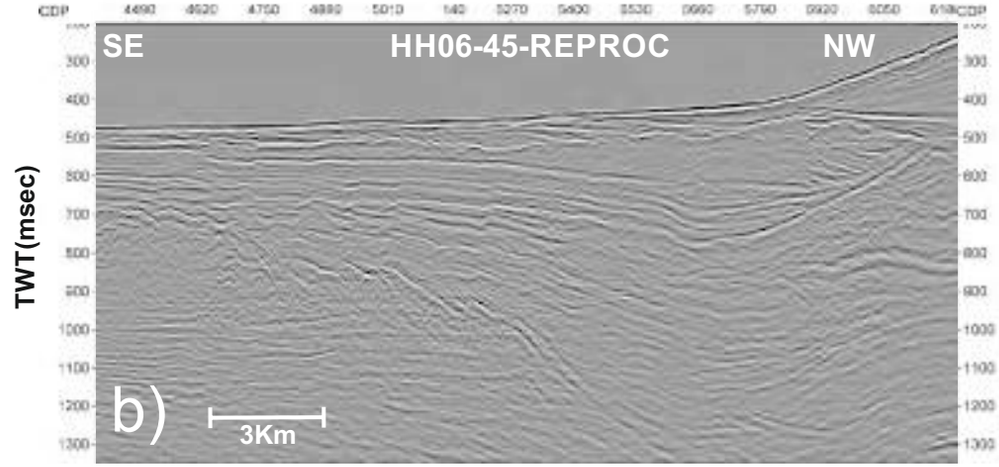
Pollution & Safety Hazard	Comment
1. Summary of operations at site	Two holes (A, B) APC/HLAPC to refusal including 4 temperature measurements, each followed by XCB to 610 mbsf; Hole C: RCB drilling ahead until 575 mbsf with the option of one or two cored intervals of 50 meters in between, RCB to 730 mbsf, log as shown on form 1
2. All hydrocarbon occurrences based on previous DSDP/ODP/IODP drilling	non
3. All commercial drilling in this area that produced or yielded significant hydrocarbon shows	non
4. Indications of gas hydrates at this location	non
5. Are there reasons to expect hydrocarbon accumulations at this site?	non
6. What "special" precautions will be taken during drilling?	non
7. What abandonment procedures need to be followed?	non
8. Natural or manmade hazards which may affect ship's operations	sailing traffic may be existent but minimized during autumn to early spring
9. Summary: What do you consider the major risks in drilling at this site?	fine to coarse volcaniclastic in the top 10 meters may be be difficult to penetrate

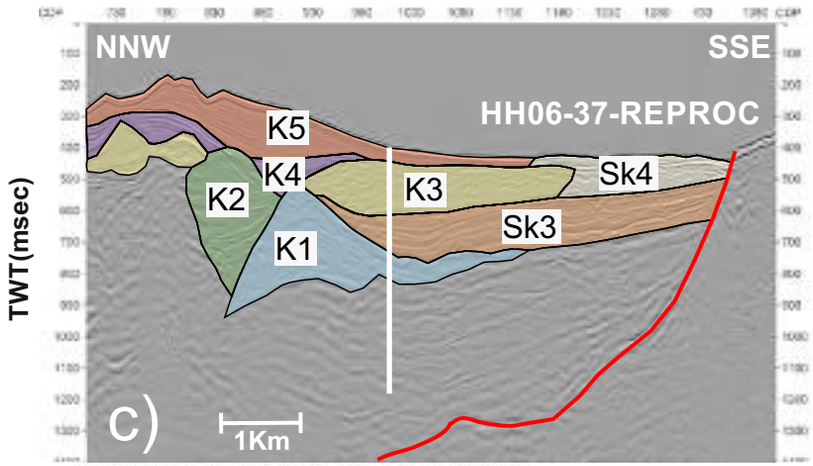
Proposal #: 932 - Add	Site #: CSK-21A	Date Form Submitted: 2019-11-22 13:07:02

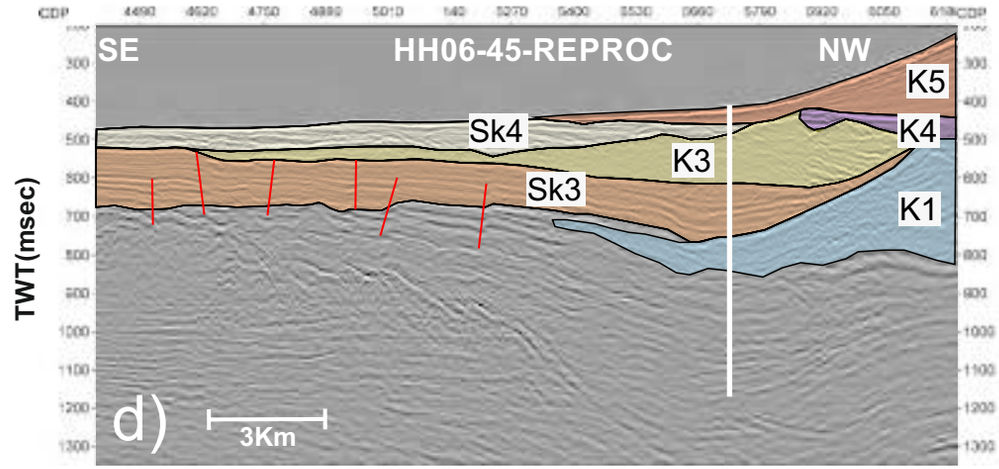
Subbottom depth (m)	Key reflectors, unconformities, faults, etc	Age (My)	Assumed velocity (km/s)	Lithology	Paleo-environment	Avg. accum. rate (m/My)	Comments
0 - 43	Seismic unit K5: AD 1650 eruption of Kolumbo	AD 1650	1.65	Volcaniclastics (pumiceous)	filled submarine rift-basin	>1,000,000	Interpretation of Hubscher et al. (2015)
43 - 190	Seismic unit K3	Pleistocene	1.75	Volcaniclastics (probably pumiceous)	filled submarine rift-basin	>1,000,000	Interpretation of Hubscher et al. (2015)
190 - 318	Seismic unit SK3: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene	1.8	hemipelagic muds, volcaniclastics, turbidites, MTDs	filled submarine rift-basin	120	Interpretation of Hubscher et al. (2015)
318 - 405	Seismic unit K1: eruption of Kolumbo	Pleistocene	1.95	Volcaniclastics (probably pumiceous)	filled submarine rift-basin	>1,000,000	Interpretation of Hubscher et al. (2015)
405 - 730	Pre-K1 levels of basin sediment fill: Volcaniclastics from Santorini (including mass flows) and marine sedimentation	Pleistocene/ Pliocene	1.9	hemipelagic muds, volcaniclastics, turbidites, MTDs	filled submarine rift-basin	80	Interpretation of Hubscher et al. (2015)

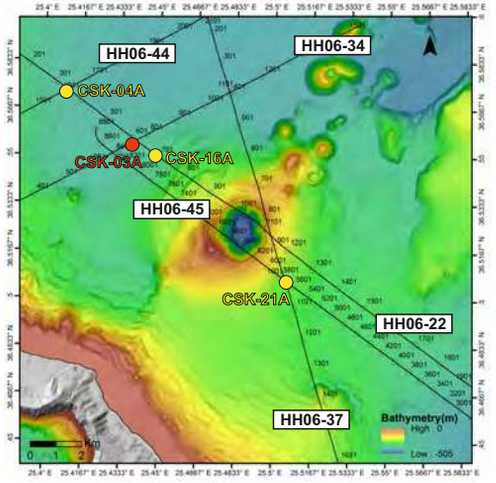
CSK-21A











CSK-21A: HH06-37-REPROC, CDP 1009 (a and c); HH06-45-REPROC, CDP 5727 (b and d)

Files to be uploaded to SSDB:
Location map: CSK-21A_location.pdf
SEGY-data data: HH06-37-REPROC.sgy, HH06-45-REPROC.sgy
Navigation data: HH06-37-REPROC.txt, HH06-45-REPROC.txt
Bathymetry: CSK_Bathymetry.grd, CSK_Bathymetry.pdf
Backscatter: CSK_Backscatter.grd, CSK_Backscatter.pdf
Gravity-FreeAir: CSK_Gravity_FreeAir.grd, CSK_Gravity_FreeAir.pdf
Gravity-Bouguer: CSK_Gravity_Bouguer.grf,CSK_Gravity_Bouguer.pdf

Site Information:
Coordinates:36.5068/25.5053
Water depth: 309 m
Penetration: 730 m

Additional data available:
Magnetic: CSK_Magnetic.grd,CSK_Magnetic.pdf
3.5kHz: Sediment_Profiler.zip, contains 3.5kHz profiles, do not run along site survey profile