Vietnam Journal of Earth Sciences, 43(3), 336-379, https://doi.org/10.15625/2615-9783/16268

Vietnam Academy of Science and Technology
Vietnam Journal of Earth Sciences
http://www.vjs.ac.vn/index.php/jse

Holocene sedimentation offshore Southeast Vietnam based on geophysical interpretation and sediment composition analysis

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Received 26 May 2021; Received in revised form 28 June 2021; Accepted 12 July 2021

ABSTRACT

Offshore Southeast (SE) Vietnam is considered a transition zone, with the sedimentary evolution of this area controlled by land-sea interactions, especially by the Holocene sea-level rise. This study presents some new findings regarding Holocene sedimentation and its linkage to the heavy mineral placers within the study area based on high-resolution seismic interpretation and sediment analysis. Our obtained results show that the Holocene sediments directly overlie the Late Pleistocene sedimentary formation, from which they are separated by an erosional/unconformity surface (R_1 seismic reflector). Sediments deposited in the Early (~11.7-8.2kyr BP), Middle-Late (8.2kyr BP-present-day) Holocene sub-epochs correspond to the Transgressive and Highstand System tracts, which were closely controlled by the three stages of Holocene sea-level rise. The recent sediments distributed on the seafloor are dominated by sand and gravelly sand, demonstrating high-energy conditions, while the heavy minerals are rich in ilmenite and zircon. Most of these are concentrated along the present shoreline zones, but we do not exclude their accumulation in the paleo-shoreline and incised channels. Two ilmenite dispersion halos (1st and 2nd order) and one zircon dispersion halo (1st order) suggest that ilmenite and zircon are the most dominant heavy minerals while gold is only observed locally. The minerals were potentially derived from the weathering products of the Triassic-Cretaceous ilmenite-, zircon-, and gold-bearing granite and granitoid in central Vietnam.

Keywords: Holocene sedimentation, heavy mineral, sea-level rise.

1. Introduction

Offshore SE Vietnam is part of a regional-scale continental shelf of Vietnam. Its northern area is connected with a narrower and higher-gradient shelf off central Vietnam, while the southern end is gradually transited to the larger shelf, known as the Sunda Shelf (Fig. 1). The study area has been fed a

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significant amount of sediments from various distal and proximal sources such as the Mekong drainage systems, SE Vietnam, and partly Holocene relict sediments. The geomorphology of the shelf is characterized by a very low gradient within the area extending from a water depth of ~5 to 175 meters. Still, it is steeper near the shore (<5 meters of water depth) and along with the shelf break (water depth of ~175-200 meters). In addition, its width is greater toward the SW, where the center part of the Mekong Delta front is located (Fig. 1).

The formation and evolution of the shelf off the coast of SE Vietnam, in particular, and the Vietnam Shelf, in general, were closely controlled by the rifting of the pre-Cenozoic basement and sedimentation during the Cenozoic, as well as by the opening of the South China Sea (East Sea) (Bergman et al., 1996; Clift, 2015; Clift et al., 2008; Clift et al., 2002; Clift and Sun, 2006; Clift, 2005; Hall, 1996; Hoang et al., 2010; Liem et al., 2021; Yan et al., 2018).

Previous studies have indicated that most of the sediments deposited off the Vietnamese shore were fed by the Red River in the North and the Mekong River in the South, while local sources released from Hainan Island and central Vietnam seem to be underestimated (Boulay et al., 2007; Li et al., 2015; Liu et al., 2016; Schimanski, 2002; Schimanski and Stattegger, 2005a, b; Szczuciński et al., 2013; Szczuciński et al., 2009). Nevertheless, mixing between local and distal sediment sources is considered an important element determining sedimentation in this area.

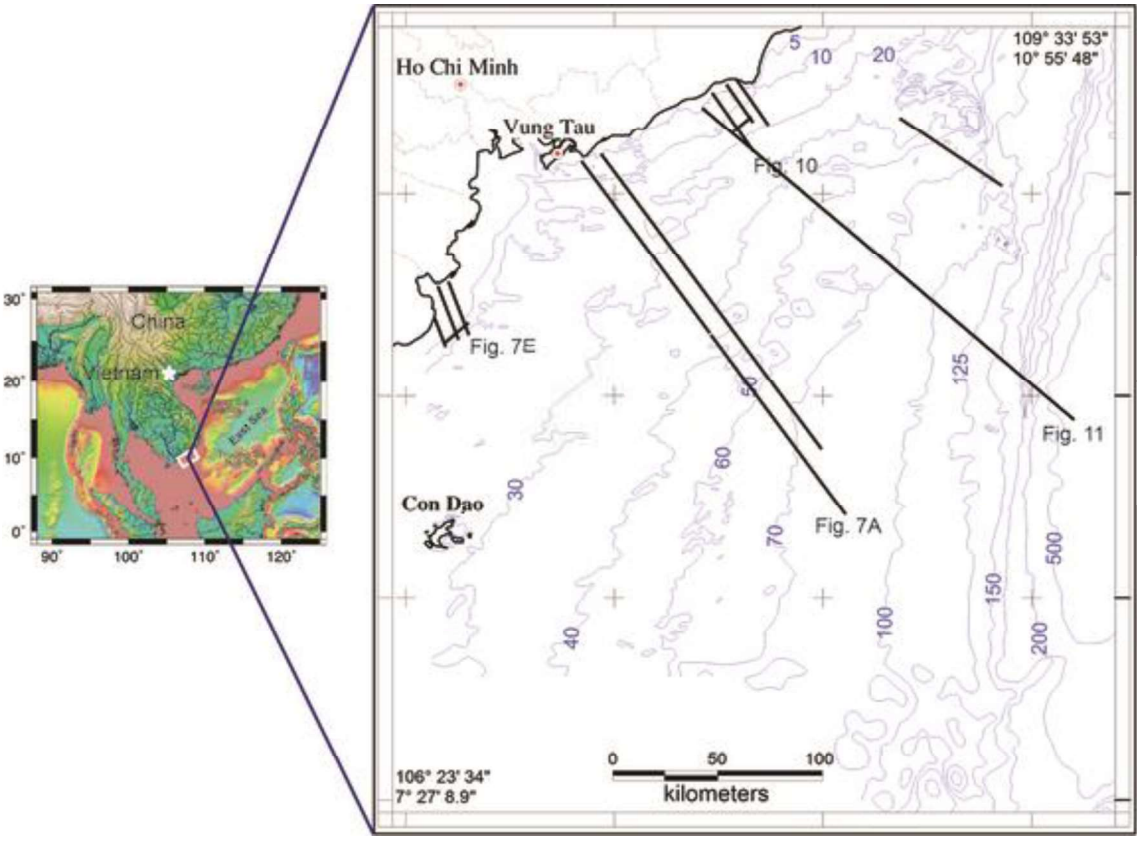

Figure 1. Location of the study area: offshore SE Vietnam.
The straight black lines are seismic survey used in this study

It is noteworthy that a period of deglaciation, which started following the end of the Last Glacial Maximum (at ~20 kyr BP), triggered a rapid sea-level rise during the end of the Late Pleistocene-Holocene Epoch (Alqahtani et al., 2015; Bush and Fairbanks, 2003; Hanebuth et al., 2000; Hanebuth et al., 2002). The post-LGM transgression event has led to a rapid estuarization of the paleo-Mekong River Delta and other major tributaries such as the Dong Nai River. Hence, the marine depositional environment and associated lithofacies had migrated landwards, accordingly.

The Lowstand sea level (Last Glacial Maximum) and subsequent Pleistocene-Holocene rapid rise in sea level had led to the formation of several paleo-shoreline zones. The shallow-water hydrodynamic processes (waves, tide) during the transgression have caused a strong erosion, produced the Pleistocene soil surface, and partially, sediment reworking process (Thanh et al., 2021). The presence of the reddish-brown can illustrate this process, poorly sorted lateritic gravels in the surface sediments at various depth levels of the seafloor. In addition, the Lowstand sea-level had also produced deeply incised valleys eroding into the paleo-shelf surface, which are identifiable by the presence of the erosional surfaces on seismic profiles. Association with these paleo-shorelines and incised channels accumulate valuable heavy minerals such as ilmenite, zircon, gold, etc.

Although the heavy minerals are enriched in the Holocene sediments, their distribution patterns and the linkage between the heavy mineral placers and Holocene sedimentation are poorly understood.

In this study, we try mapping the internal structures and distribution of Holocene sedimentary formation and its controls on the accumulation of the major heavy mineral placers off the shore of SE Vietnam.

2. Overview of the research area

The study area extends the submarine Mekong Delta, a part of the Sunda Shelf (Figs. 1, 2). This area extends from a water depth of 0 to ~200 m. Since most of the sediments released from the Mekong River are trapped off the SE Vietnam continental shelf, the seafloor in this area is characterized by a low gradient. The depth contours are relatively parallel to the shoreline (Fig. 1).

Based on previous interpretation of the industrial seismic data together with magnetic and gravity data, the stratigraphy of the study area was delineated into two different parts (Figs. 2-4):

Pre-Cenozoic basement: The Pre-Cenozoic basement in the study area has been well defined by several industrial wells for oil and gas exploration. Most of the basement rocks are granite of the Dinh Quan - Deo Ca (J_3-K_1 *dq-dc*) and Ankroet (K_2 *ak*) Complexes, whose ages vary from the Late Jurassic to the Late Cretaceous. The lithologies of the intrusive rocks are sub-hederal, medium-fine-grained biotite granite, two mica-granite, porphyritic granite, pegmatite, and aplite (Nguyen et al., 1998a, b; Tran et al., 1997).

Cenozoic sedimentary formation: This is the youngest formation overlying the rifted Pre-Cenozoic basement rocks (Fig. 5). The biostratigraphic constraints derived from industrial wells show that the Cenozoic overburden has accumulated from the Eocene time until the present day. This era's sedimentary environments and related lithofacies are relatively diversified, changing from the Eocene - Oligocene, syn-rifting fluvial-lacustrine, very coarse to very fine-grained clastic sediments to the Miocene - Quaternary post-rift, thermal subsidence-driven marine sediments (Fig. 5).

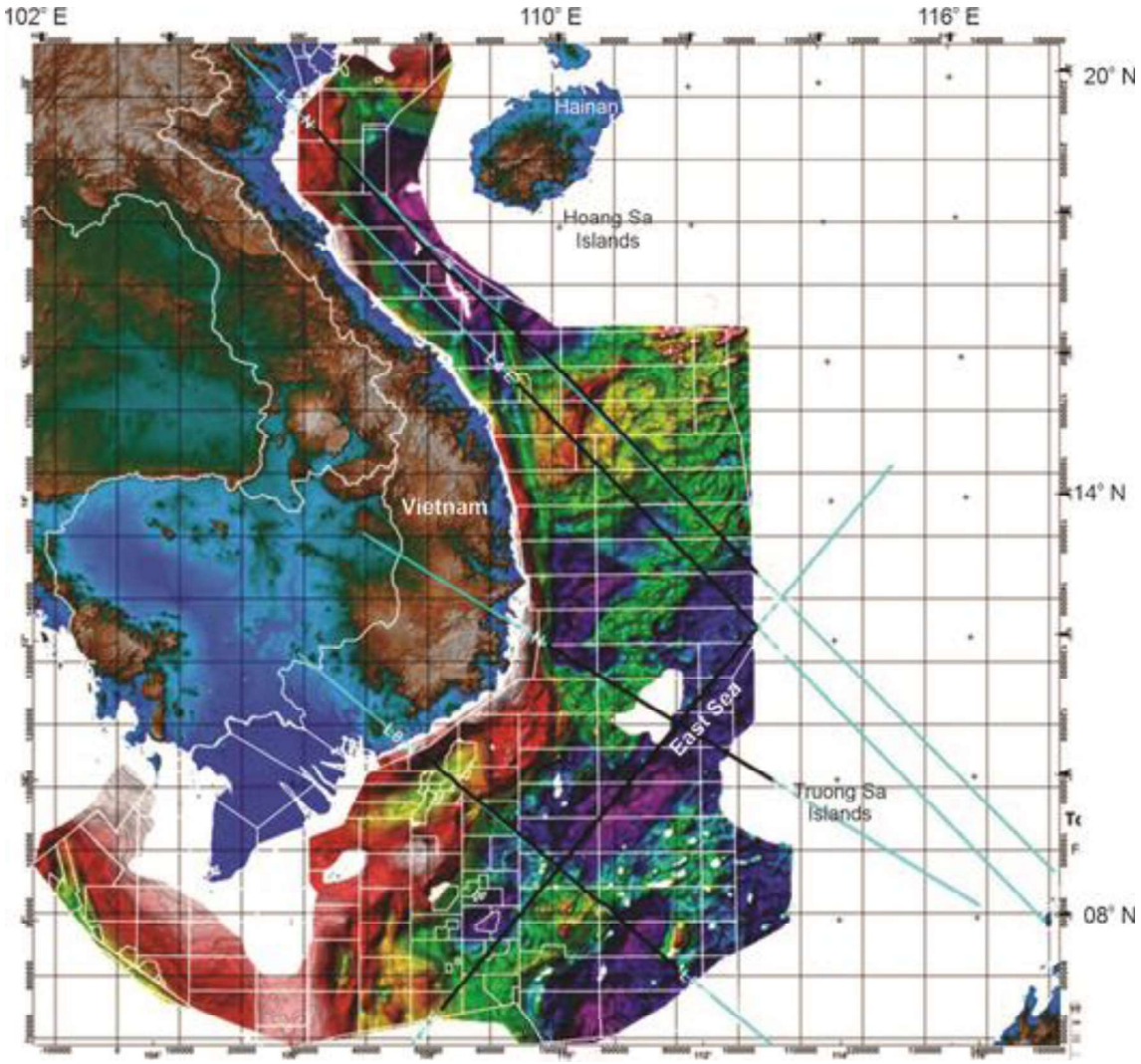

Figure 2. Paleogeomorphology of the pre-Cenozoic basement within the study area and East Vietnam Sea based on gravity data (the gravity data were provided by VPI)

The Late Pleistocene-Holocene sequences on the SE shelf indicate that their formation was controlled by the Late Pleistocene-Holocene sea-level fluctuations (Tjallingii et al., 2010, 2014; Bui et al., 2013; Liu et al., 2013; Thanh et al., 2021). Most of the sediments of this epoch consist of coarse-grained fractions, while fine-grained sediments dominate the subaqueous Mekong River delta. In addition, the Holocene formation is also characterized by widely observed incised valleys and sand waves, which are clearly seen on seismic profiles and side-scan sonar images (Bui et al., 2009; Kubicki, 2008). The generations of incised valleys on the shelf have been identified (Bui et al., 2013; Liu et al., 2017; Thanh et al., 2021; Tjallingii et al., 2010).

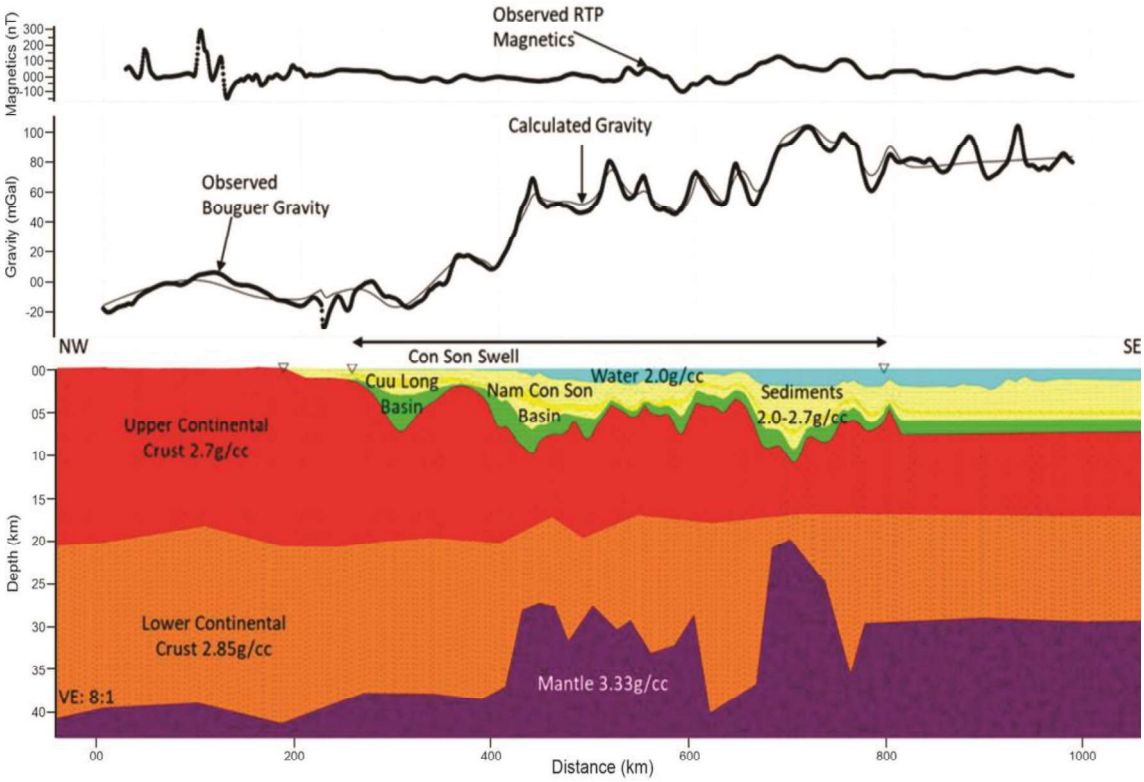

Figure 3. Magnetics and gravity profiles: Interpretation for geological model of the SE Vietnam continental shelf and adjacent areas (Magnetics and gravity data were provided by VPI)

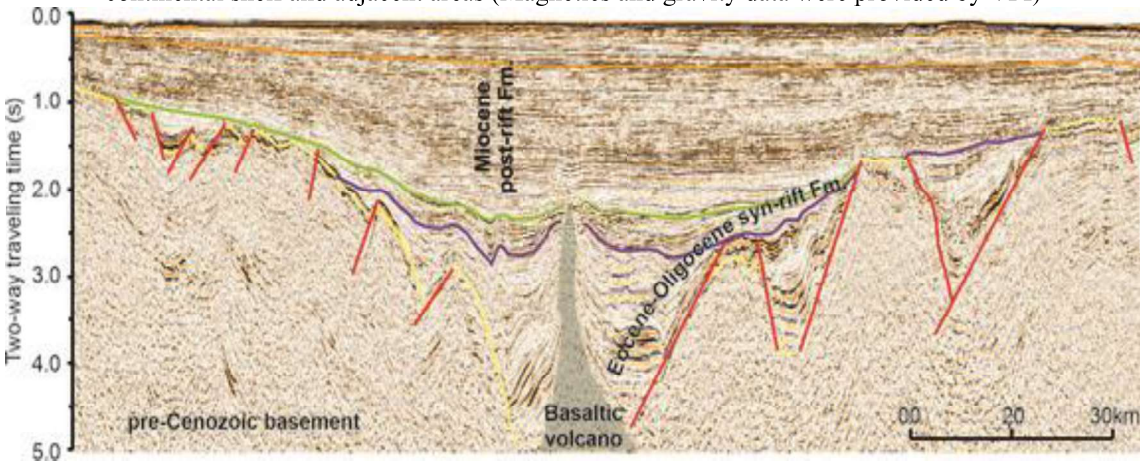

Figure 4. Interpreted seismic profile showing distribution of the pre-Cenozoic basement and the Cenozoic sedimentary formation of offshore South Vietnam

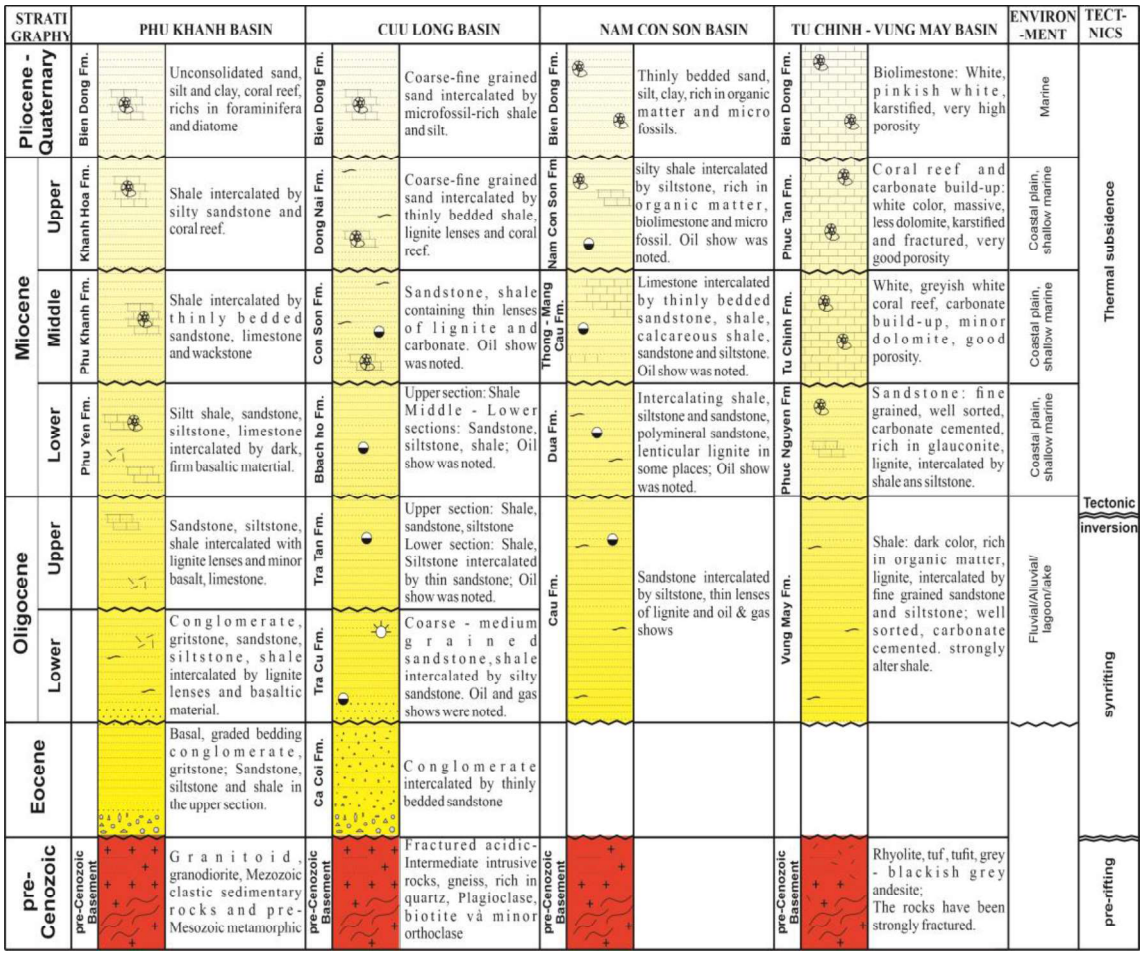

Figure 5. Correlated stratigraphy of the major sedimentary basin in the study area

3. Database and methodology

3.1. Database

To conduct this study, the authors used the following data sets:

Seismic data, including inlines and crosslines covering the whole study area (Fig. 1), consisting of high resolution, medium resolution, and industrial data sets. These data have been acquired by different contractors using different bandwidths and sources.

Apart from the seismic profiles, the industrial seismic and magnetic-gravity data were also collected to support our interpretation of the regional geological settings and define stratigraphy of the Holocene sediments in the deeper area, where the quality of the high-resolution seismic data is limited.

We used 580 grain-size samples of recent sediments and 635 heavy mineral samples of recent sediments regarding sediment mapping and interpretation.

Details of sediment and heavy mineral samples are presented in Table 1 and Appendixes 1, 2.

Table 1. Statistics of sediment classification and basic physical properties

Sediment group/value		Mean size (micron)	So	Sk	K	Distribution area	
						Km^2	Percentage (%)
sM	Min	21.72	1.37	-0.45	0.69	8,728.0	14.8
	Max	70.51	5.97	0.74	3.95		
	Average	49.90	3.09	0.26	1.90		
S	Min	105.09	1.25	-0.32	0.64	5,653.0	9.6
	Max	844.50	2.65	0.64	2.83		
	Average	247.86	1.81	0.33	1.27		
mS	Min	34.45	1.39	-0.70	0.72	1,137.4	1.9
	Max	304.57	8.91	0.67	3.61		
	Average	109.50	3.74	-0.22	1.48		
gS	Min	32.53	1.15	-0.43	0.36	39,550.0	67.1
	Max	802.11	10.43	0.85	6.64		
	Average	311.36	2.33	0.44	1.51		
gmS	Min	38.16	1.83	-0.56	0.52	3,907.0	6.6
	Max	512.67	11.50	0.44	3.87		
	Average	201.19	5.71	-0.05	1.56		

3.2. Study methods

3.2.1. Seismic interpretation

The main high-resolution seismic data used in this study were acquired by the Division of Marine Geology and Mineral Resources during the 2018-2019 survey campaign. The acquisition was conducted in four short lines in the shallow water and two long lines extending from the nearshore zone to the outer shelf region (Fig. 1), using single-channel seismic acquisition systems. In addition, medium and industrial seismic data were provided by other marine research centers and oil and gas contractors.

Once processed, seismic data were loaded onto a workstation for interpretation using Kingdom Suite software. A seismic profile has initially subdivided into different packages following the basic principles of seismic stratigraphy, as proposed by Vail et al. (1977) and Veenken (2013). Unlike deep seismic exploration, the classic boundary horizons such as onlapping, down lapping, top set, erosion terminations are not always identified in flat-lying and horizontal reflection sections of the high-resolution seismic profiles. In theory, different lithologies of geological strata may introduce different acoustic impedances (the density of the rocks multiplies the traveling velocity of seismic waves) (Vail et al., 1977). This means that the reflection coefficient between two strata with contrasting acoustic impedance will be different from zero, and hence, a lithological boundary is given. Therefore, the boundary of high-resolution seismic packages can be delineated based on clear contrast in the seismic facies and reflection configurations (Thanh et al., 2018). The defined stratigraphic boundaries were subsequently correlated with regional stratigraphy for the determination of their age. Furthermore, major structures like faults and folds were interpreted based on the deformation and displacement of the seismic reflections along the faulting planes.

3.2.2. Granulometric analysis

Since sediment samples collected from sea beds are wet materials whose particle size varies from very fine (mud) to significantly large (gravel), wet sieving is the main technique used for grain-size analysis. The step size between two consecutive fractions was established following the modified Wentworth grain-size scale (Fig. 6A) (Wentworth, 1922). The sample was first mixed and steered with water until it

becomes suspension. Then the mixture is poured through different stacked sieves, which were attached with a shaker for 5-10 minutes. The freshwater flows through the sieving system until it becomes clear. Retaining sediments in each sieving class were collected, dried, and weighted for subsequent statistic computation.

Once each fraction had been separated and scaled, the data were subjected to statistical calculation using the ternary diagram proposed by Blott and Pye (2001) for sediment classification and computation of physical properties (Fig. 6B), using the statistical calculation method introduced by (Folk, 1954; 1974; Folk and Ward, 1957). These are the basic input data for mapping recent sediment distribution in this study.

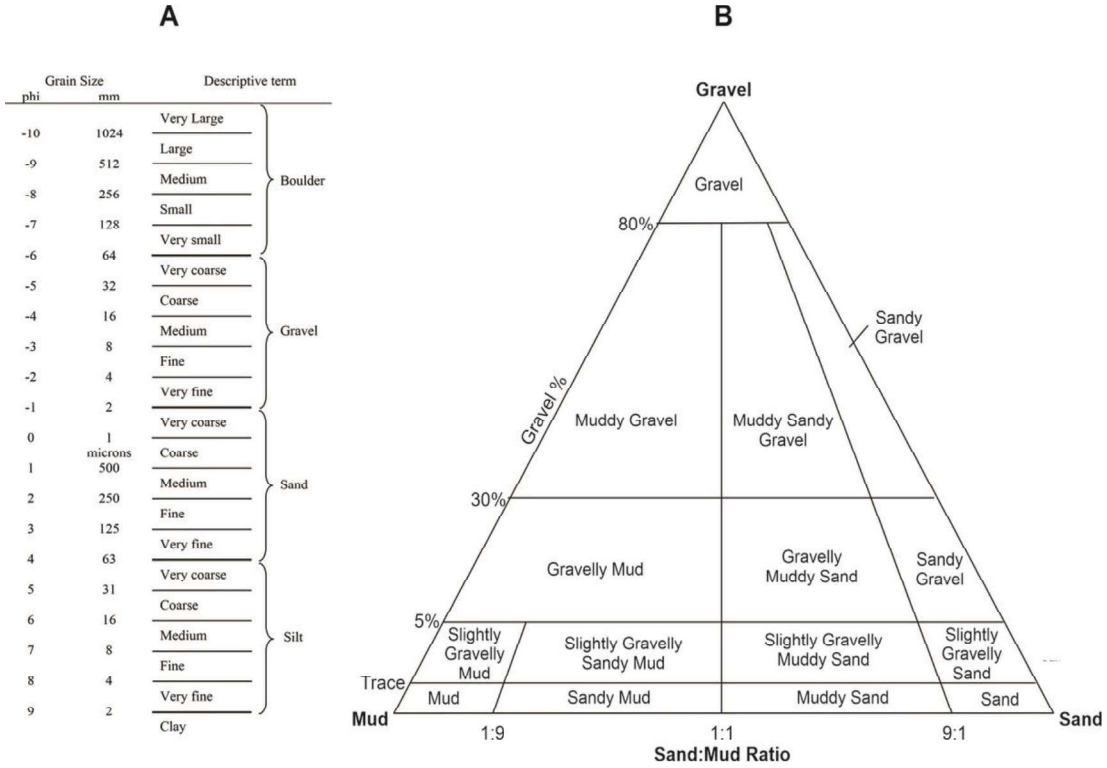

Figure 6. Sediment nomenclature: (A) grain-size scale reproduced after Wentworth (1922); (B) Ternary diagram for sediment group classification reproduced after Blott and Pye (2001)

Sediment samples were first panned out to remove the majority of the lighter materials, and the remaining heavy minerals were subsequently separated using Bromo form heavy liquid. The heaviest fraction was washed under freshwater before examining heavy mineral composition under a binocular microscope. The percentage of each heavy mineral was used to compute the different thresholds of the corresponding dispersion halos using the following formula:

$X_1 = \overline{X} + \sigma$

$X_2 = \overline{X} + 2\sigma$

…… $X_n = \overline{X} + n\sigma$

where:

$\overline{X}$ - Average content of heavy mineral

X_1, X_2,… X_n - the 1st-, 2nd-,… n^{th}-order thresholds of the dispersion halos

σ-Standard deviation of the value set (X_1, X_2,… X_n).

4. Results

4.1. Holocene sedimentation

The distribution of the Holocene sediments in the study area is illustrated using an interpreted seismic cross-section in Fig. 7A.

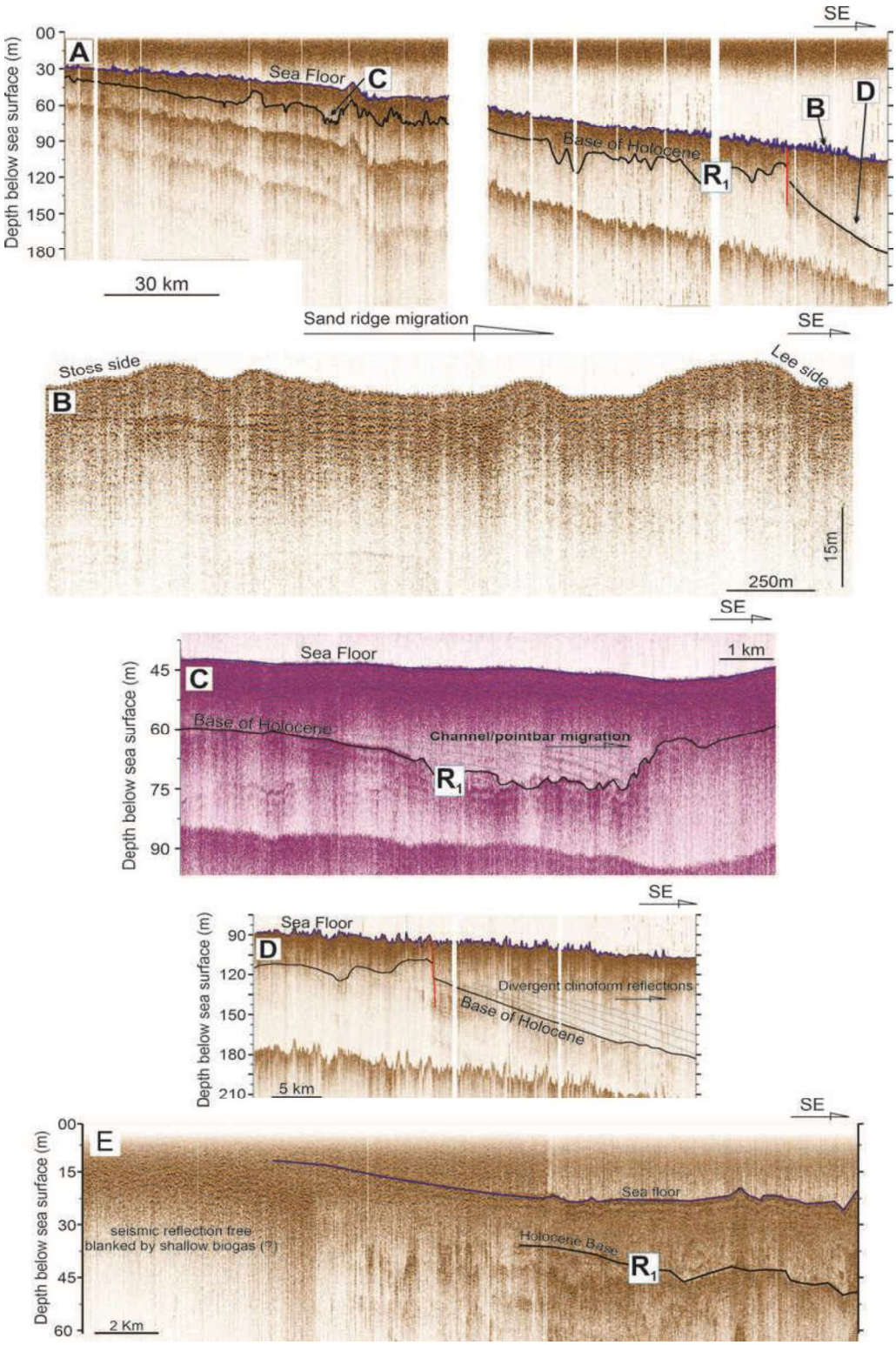

Figure 7. Interpretation of the Holocene sediments based on high-resolution seismic data

Overall, its upper boundary is marked by the present seafloor. In contrast, the lower boundary is identified by a clear erosional/unconformity surface, which is named as R_1 reflection surface (Fig. 7), which separates the Holocene formation from the underlying Pleistocene sediments. The Holocene sedimentary formation is characterized by a thickness of ~5-65 m and sub-horizontal to low-angle-inclined bedding within the continental shelf, which tilts toward the deeper water area. It is noteworthy to indicate that sand waves are commonly observed on the seafloor (Fig. 7B). The sand waves produce a typical bed form, whose wavelength varies from ~50 to hundreds of meters with different slope angles. The stoss side tilts shoreward, while the lee side (the steeper side) dips to the SE. Although the gravity-driven submarine landslide and active faulting within the shelf are not strong, several active faults were observed to penetrate and displace the seafloor (Figs. 7A, D). They are all high-angle normal faults, causing the southeastern walls to subside. Hence, sediments quickly fill in this subsiding mini-basin, as evidenced by the divergent seismic reflections (Figs. 7A, D).

It can be seen that the lower boundary of the Holocene stratum (R_1 reflector) is marked by a series of paleo-channel incisions (Figs. 7A, C). Similar to the sand wave morphology, the incised channels show two different sides, with the steeper side being situated to the SE of the cross-section (Fig. 7C).

To the south of the study area, a part of shallow water (water depth of <7 m) close to the Mekong River mouth shows white and reflection-free seismic data (Fig. 7E). This bad seismic signal cannot be attributed to the acquisition technique and was probably blanked by the presence of nearshore and thin biogas-containing sand layer, which will be further interpreted in the discussion part of this paper.

4.2. Surface sediment classification and distribution

Based on the granulometric analysis and statistical data, five sediment groups were classified. The surface sediments within the study area were classified into five sediment groups: (1) muddy sand; (2) gravelly muddy sand; (3) sand; (4) sandy mud; and (5) gravelly sand. The detailed distribution of each fraction and the corresponding basic physical properties are presented in Table 1 and Fig. 8.

The surface sediments within the study area were classified into five sediment groups: (1) muddy sand; (2) gravelly muddy sand; (3) sand; (4) sandy mud; and (5) gravelly sand.

The muddy sand group was observed locally in the shallowest area, with water depth varying from ~2 to 5 m, just off Vung Tau City, with some minor distributions being observed at ~7-13 m and ~38-55 m in the northeastern margin (Fig. 7). This is the smallest group, extending over ~1,137.4 km^2 (1.9%) of the total study area. The sediments belonging to this group varied from very fine to medium sand, with very fine sand predominating ($\overline{D}$: 34.45-304.57 μm, average: 109.5 μm), that was well to very poorly sorted, but commonly poorly sorted (So: 1.39-8.91, average: 3.74) and with very fine to very coarse skew, more often fine skew (Sk: -0.70-0.67, average: -0.22). The granite blocks' sand fraction was of subangular-angular texture, with quartz, feldspar, lithic, and shell fragments predominating. In contrast, the sandy sediment in deeper water and/or along the coastal eolian sand dunes was well-sorted, possessed fine-grained texture, and was composed almost entirely of quartz.

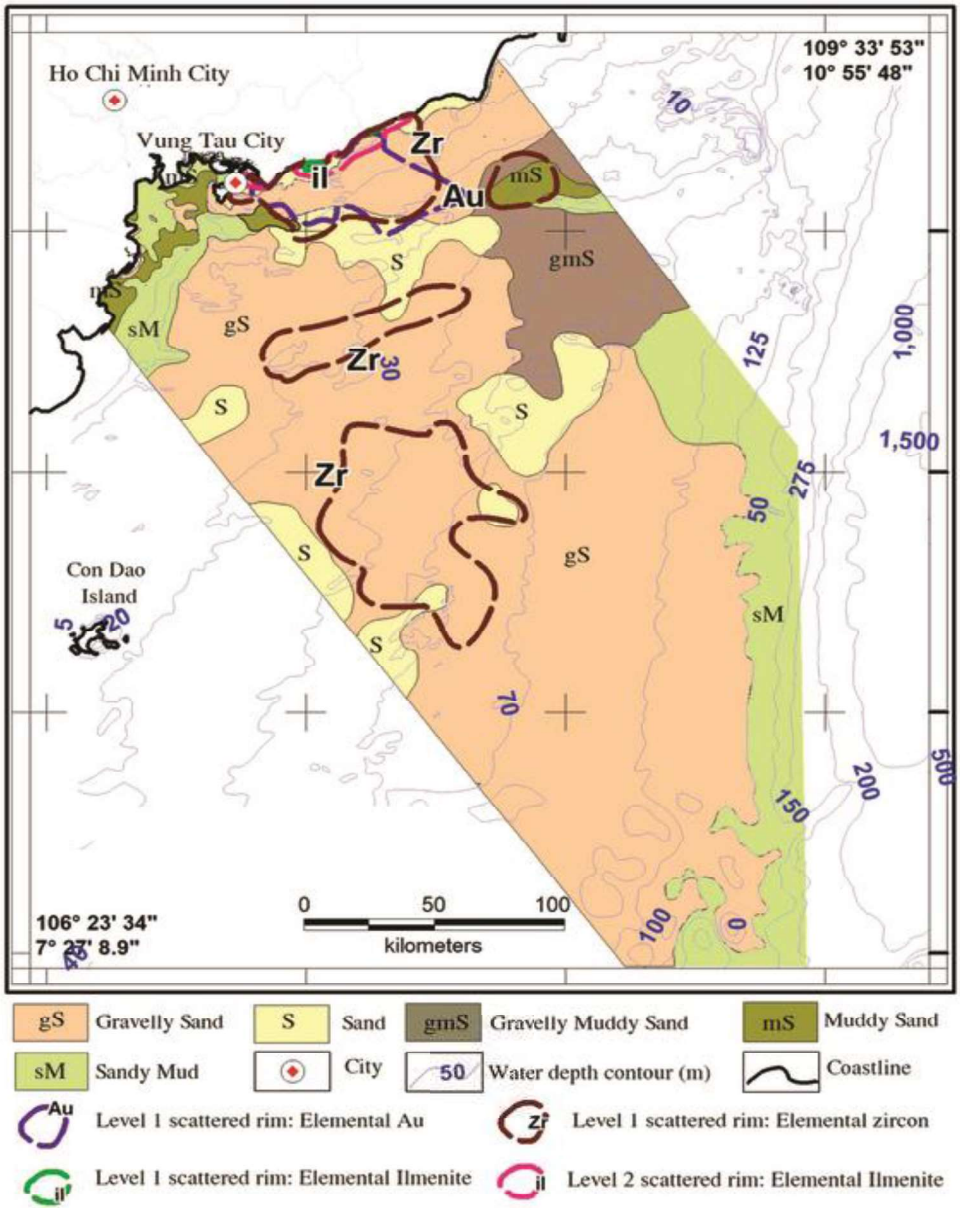

Figure 8. Distribution of surface sediments and heavy minerals in offshore SE Vietnam

The gravelly muddy sand group was locally distributed in a small area of ~3,907.0 km^2 (~6.6% of the region), with water depth varying from ~20 to 70 meters in the northeastern part of the study area. The statistical data for this fraction shows that the mean size of the gravelly muddy sand varied from very coarse silt to very coarse sand, but mainly fine sand ($\overline{D}$: 38.16-512.67 μm, average: 201.19 μm), was moderate to very poorly sorted, mostly very poorly sorted (So: 1.83-11.50, average: 5.71), and very fine to very coarse skew, although with most of the fraction showing a symmetrical distribution (Sk: -0.56-0.44, average: -0.05).

The sand group was distributed erratically, producing discontinuous sand bars at water depths of ~10-30 and ~55-70 meters, while

the nearshore sand (water depth of ~0-10 meters) accumulates in a narrow and continuous sand strip within a wave-breaking zone and runs along the coast, starting from Vung Tau City and moving northeastward (Fig. 5). The sand grain size varied from very fine to coarse-grained. Still, it was commonly fine-grained ($\overline{D}$: 105.09-844.50 μm, average: 247.86 μm), was very well to poorly sorted, mostly being moderately sorted (So: 1.25-2.65, average: 1.81), and with very fine to very coarse skew, often with very coarse skew (Sk: -0.32-0.64, average: -0.33).

The sandy mud group was the sediment field with the second most widely distributed surface within the study area, covering ~8,728.0 km^2 (~14.8%). It comprises two narrow strips: the smaller deposit is near the shore, from Vung Tau City southwestward, while the larger one is situated along with the shelf break and adjacent areas, where the water depth varies from ~125 to 175 m more. The sediment group contains coarse silt to very fine sand ($\overline{D}$: 21.72-70.51 μm, average: 49.9 μm) and is well to very poorly sorted, predominantly poorly sorted (So: 1.37÷5.97, average: 3.09), with fine to very coarse skew, more often with coarse skew (Sk: -0.45÷0.74, average: -0.26).

The gravelly sand group was the most common sediment group in the study area, being widely distributed over ~39,550.0 km^2 (~67.1%) of the study area, from very shallow water (water depth of ~5 m) to water depths of ~125 m, where the continental shelf becomes steeper (close to the shelf break) (Fig. 7). The analytical data of grain size show that the mean particle size varied from very coarse silt to very coarse sand, with medium sand predominating ($\overline{D}$: 32.53-802.11 μm, average: 311.36 μm), their sortness ranged from very well to very poorly sorted, most commonly poorly sorted (So: 1.15-10.43, average: 2.33), while demonstrating very fine to very coarse skew (Sk: -0.43-0.85, average: -0.44).

4.3. Heavy mineral distribution

Our panning data show that the most abundant and valuable heavy minerals associated with surface sediment in the region are ilmenite, zircon, and gold. The concentrations of these minerals are displayed as dispersion haloes in Fig. 5.

Zircon grains were widely observed at different water depths varying from ~0 to 20, ~30 to 40, and ~35 to 65 meters (Fig. 8). The zircon content varied from 181.5 to 5667g/t, with an average of 551.28g/t. Its distribution was concentrated on localized areas, bordered by the 1st order of dispersion halo.

Almost all ilmenite heavy placers were discovered along the coastal sand dunes and beaches to the Northeast of Vung Tau City (Fig. 8). Although this heavy mineral disperses in narrower areas relative to the zircon, its content demonstrates a wider range, from ~2.862 to 173.807kg/t, with an average of ~27.98kg/t. This uneven distribution allowed us to compute two orders of distribution halo: the 1st-order halo was limited by a threshold of 27980.9g/t, and the 2nd-order dispersion halo was for higher grade samples.

Gold placers accumulated in the shallow sediments (water depth of ~0-20 meters) (Fig. 8). However, its concentration was relatively low, varying from ~81 to 406mg/t, with an average of 187.7mg/t.

5. Discussions

5.1. Holocene sediment evolution

The Holocene Epoch is the most recent geological time period. The formation of these sediments was controlled by paleoclimate conditions, which were directly linked to the Holocene deglaciation and the associated sea-level rise (Schimanski and Stattegger, 2005b). During the time of the Last Glacial Maximum,

the whole Sunda continental shelf was exposed and deeply incised by the paleo-channels, as the sea-level was at ~130 m below the present-day level (Fleming, 2000; Fleming et al., 1998; Milne et al., 2005; Ta et al., 2002; Xue et al., 2010) (Fig. 9).

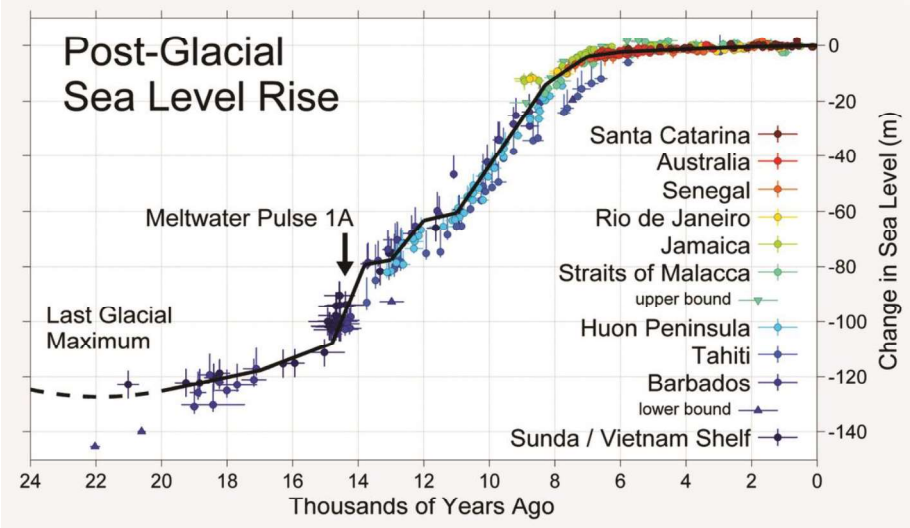

Figure 9. Global and Vietnam Holocene sea-level change since the Last Glacial Maximum (from Rohde R.A., 2005)

The Early Holocene (~11.8-8.2 kyr BP) demonstrates a rapid rise in sea level (Fig. 9), causing the paleo-shoreline to migrate landward, and hence the river delta environment gradually becomes estuarized. The entire lower part of the Holocene shelf and the incised valleys were quickly filled by the transgressive sediment systems tract, which can clearly be seen from the erosional/channel-filled and onlapping seismic configurations in Figs. 7A, C. The Middle Holocene (~8.2-6.0kyr BP) shows a slower rise in sea level (Fig. 9), reaching an elevation of ~2.5 m above the present sea level, which corresponds with the Highstand systems tract. During this time, sediment supply was faster than the creation of space to accommodate it. Because of this imbalance, sediments from the Mekong River system and other local sources were prograded and overspilled toward the deepwater area, forming a coarsening lithological order upward. This interpretation is supported by the stronger amplitude and average energy of seismic reflections upward in the upper Holocene section (Figs. 10-12). The gradual transgression during the Middle Holocene is also evidenced by a growth of the carbonate build-up (a type of coral reef) in Fig. 12.

In contrast, the ~3.0kyr BP - Present period reflects a gradual regression: the paleo-shoreline retreated from ~2.5 m to the present-day position (equivalent to the regressive/falling stage systems tract). This interpretation is evidenced by the widely observed presence of Middle Holocene marine sediments and the sea notches left behind the present coast in the Mekong River delta. The uppermost seismic section observed in Figs. 10, 11, showing continuous, wavy, parallel seismic reflections, suggests that the whole study area steadily subsided relatively slowly. In addition, the top sediment drape was displaced by minor faults cutting through the sea bed, as shown in Fig. 11. This feature implies that the modern faults were recently still active.

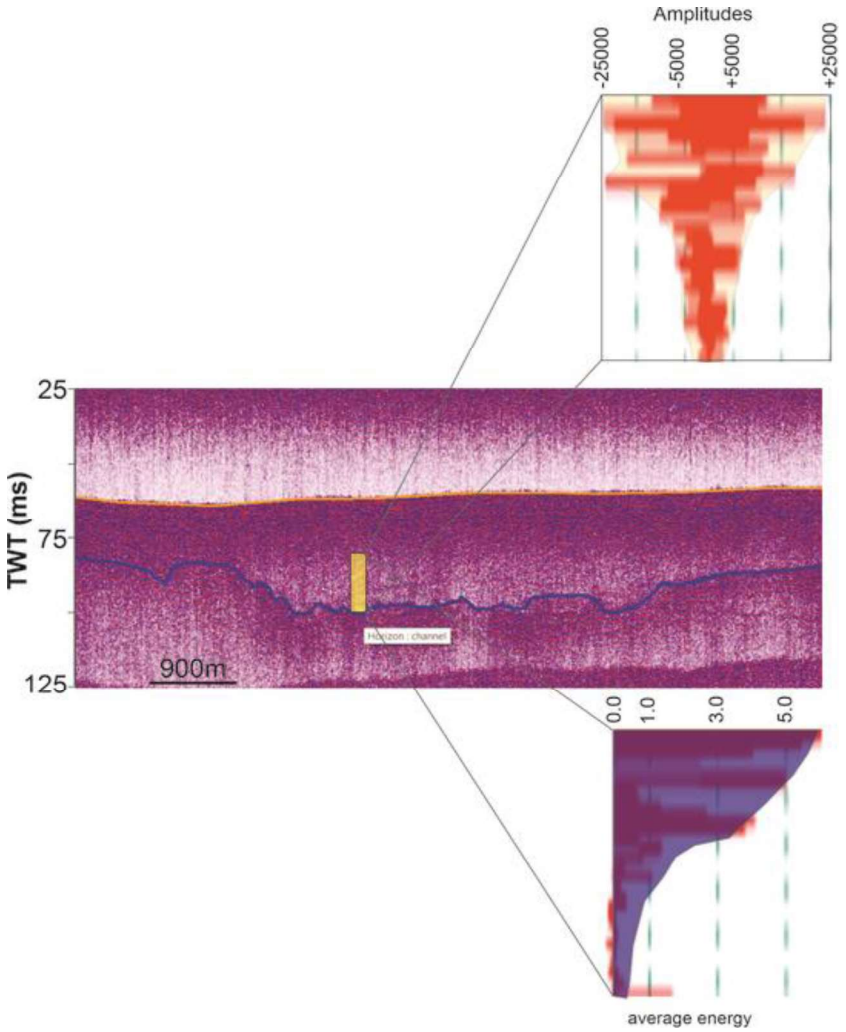

Figure 10. Seismic amplitude and average energy weakening upward, consistent with the increasingly fine upward order of the sediments interpreted from the seismic profile

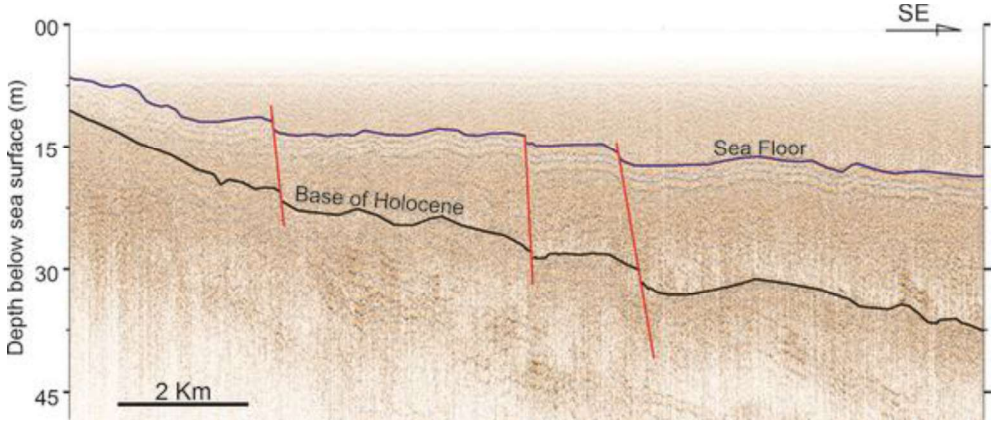

Figure 11. Wavy, continuous and parallel seismic reflections of the uppermost section lying on divergent seismic units

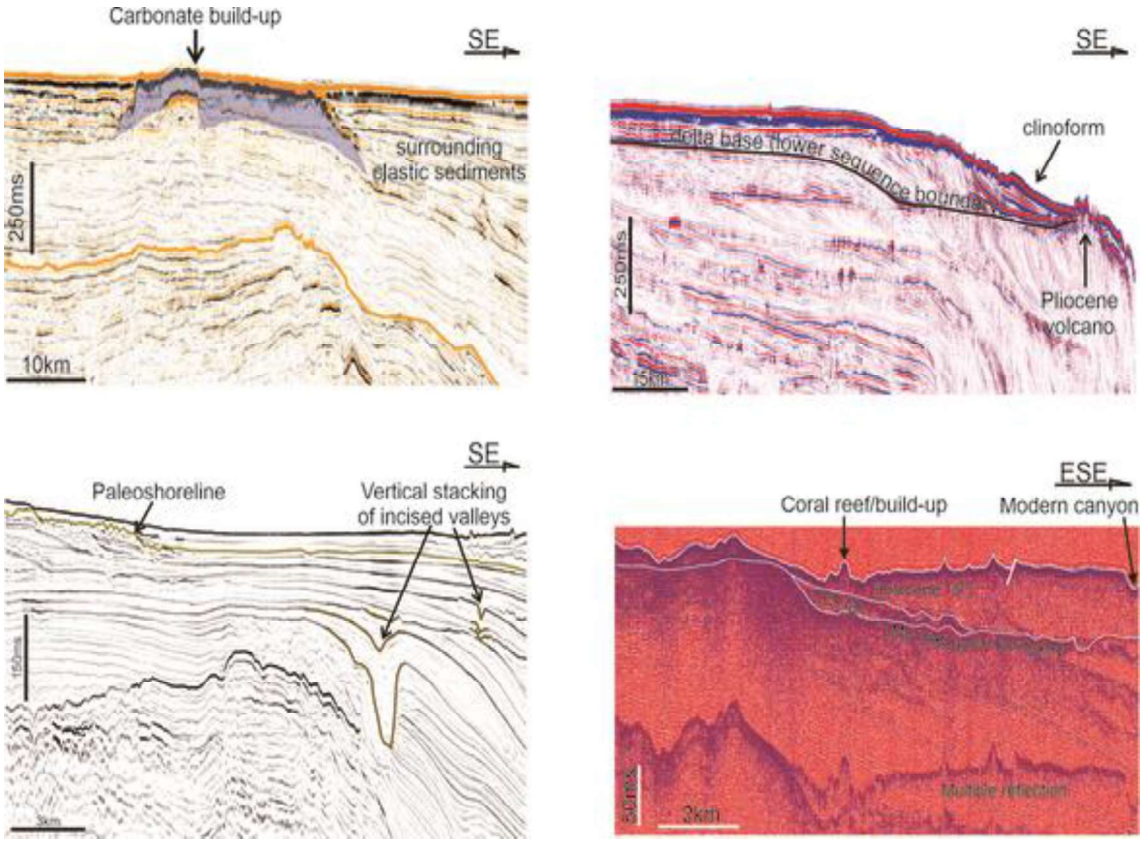

Figure 12. Typical seismic reflection configurations demonstrating uneven distribution of the Holocene sediment within the study area

As described in the sections above, many parts of the seafloor are dominated by the presence of the sand-wave structures (Fig. 7B). Although mechanisms of the sand-wave formation introduced by different authors are different, it suggests high energy and active sediment dynamics regimes, which is likely associated with the reworking process under tide and wave influences.

The asymmetrical morphology of the incised valleys (Fig. 7C), together with the clinoform seismic reflections dipping in the same direction (Fig. 7C), allowed us to interpret that horizontal erosion of the paleo-fluvial systems during the LMG caused the channel migration toward the SE. In contrast, the clinoform seismic reflections demonstrate an extension of the point of bar deposit during the channel shifting.

5.2. Sediment composition and heavy mineral placer: source to sink analysis

Figure 8 shows that most of the seafloor within the study area is underlain by sand and gravelly sand, meaning that the flow energy regime (current, wave, and tide) for this area is relatively strong during the recent time preventing fine sediments from deposition. While sandy material is mainly fine-medium-grained, beach sand near the hinterland demonstrates angular-subangular and coarse-very coarse-grained textures, suggesting that the beach sand in this area was derived from local sources. However, the mixing of muddy and gravelly materials is likely a different

story, as gravel transport results from very high energy flow (Dinh et al., 2020). In contrast, muddy sediment is deposited under much calmer flow conditions. As mentioned above, the gravel deposits were observed at various depths and are characterized by an abundance of brown, poorly sorted, and well-rounded lateritic fragments (Fig. 13). We interpreted these assemblages as lag gravels left on the paleo-shelf surface when exposed during the Last Glacial Maximum (Ha et al., 2019). The gravelly materials were commonly accumulated along the paleo-shorelines at various water depths. Due to the rapid sea-level rise during the Holocene, giving rise to an estuarization process and trapping most of the coarse-grained sediments in the upper reach of the river mouth, only finer materials (mud and clay) were passed to the deeper sea as suspended matter to overlie the pre-existing gravel deposits ultimately.

Figure 13. Reddish brown lateritic muddy gravel near Hon Khoai Island, offshore SE Vietnam

Although heavy minerals are commonly observed in the study area, the most abundant and valuable minerals were ilmenite and zircon, with gold placers only being discovered locally in a few places. Previous analytical results show that ilmenite and zircon are often associated with fine-medium sand and are enriched along the paleo-channels and shorelines (Figs. 8, 14). In particular, the SEM images show a decrease in the grain size of the ilmenite along the North-to-South direction, which is consistent with the prevailing longshore current
(Fig. 15).

Figure 14. Black sand-ilmenite accumulation along the present shoreline, North of the study area

This well-matched distribution pattern of the ilmenite and possibly zircon grains allowed us to infer that the heavy minerals may have been released as a product of the weathering of Triassic-Cretaceous granite-granitoid sources in central Vietnam. It is noted that no commercial ilmenite or zircon deposits have been discovered onshore, meaning that these heavy minerals were crystallized in the source rocks as minor associated minerals and have subsequently been enriched in Holocene sediments by a combination of physical/chemical weathering and sediment sorting processes (Hung et al., 2019). While gold mineralization is widespread, and most of the gold occurrences discovered onshore were said to be Orogeny-related gold mineralization originating during the Mesozoic, its extremely high density possibly prevents gold from transporting over long distances; hence, this mineral is not abundant in distant areas.

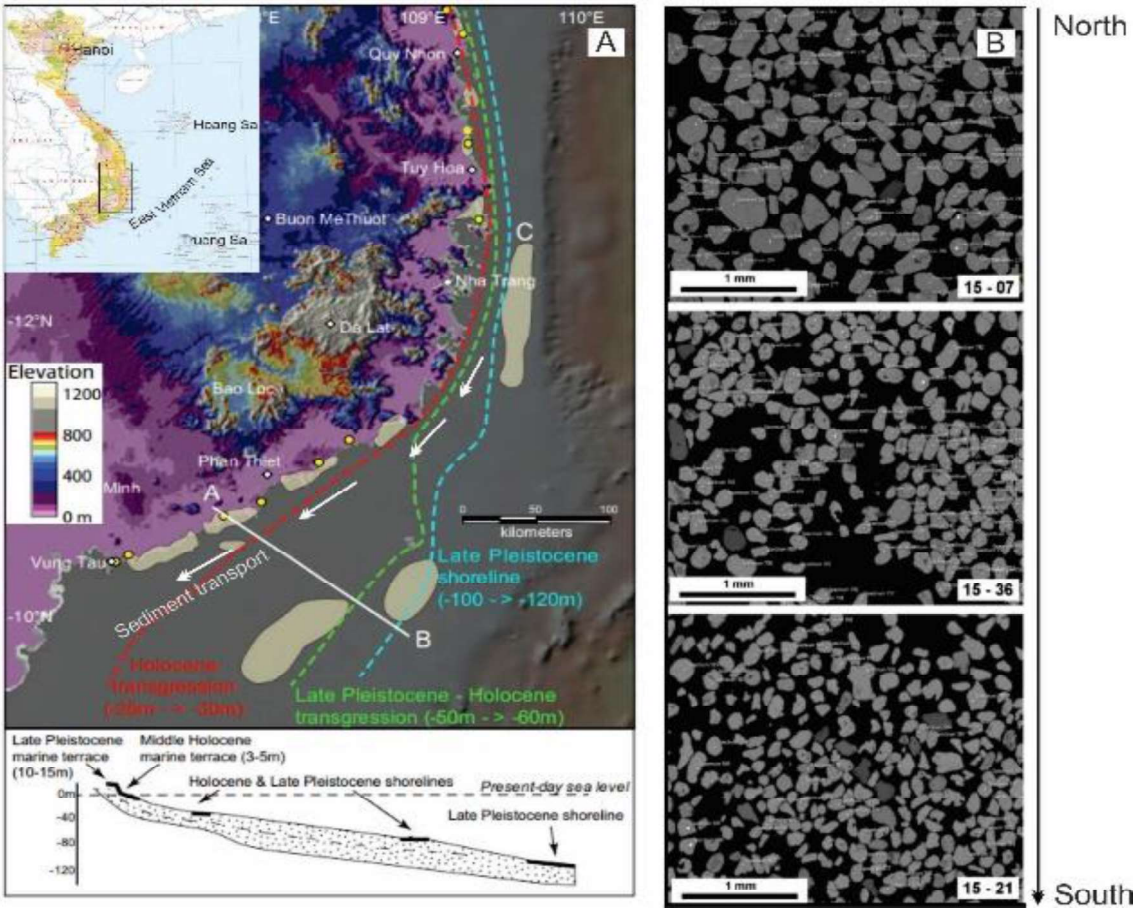

Figure 15. Sediment dynamics and sorting: (A) Paleo-shoreline and longshore current direction (after Nguyen et al. (2018)), (B) grain size of the ilmenite grains decreases southward

6. Conclusions

The continental shelf off Southeast Vietnam is a seaward extension of the Mekong River delta. The evolution of this area in the Holocene is supposed to be associated with the Mekong River Delta and the Sunda shelf evolution. Based on high-resolution seismic interpretation coupled with analyses of physical properties and mineral composition, the following conclusions can be drawn:

Holocene sedimentary formation can be clearly identified as having been deposited directly onto an erosional/unconformity surface (R_1 seismic reflector) that separates the Holocene sediments from the older/underlying sedimentary formations. This unconformity boundary resulted from the strong erosion and weathering processes during the Last Glacial Maximum.

The lithofacies and depositional environments of the Holocene sediments were closely controlled by the rapid rise in sea level during the Holocene, corresponding to the transgressive (Early Holocene), Highstand (Middle-Late Holocene) system tracts. The surface sediment distribution shows a predominance of sand and gravelly sand materials, reflecting a high-energy depositional environment. However, the muddy gravel group was produced by two different processes: The gravel resulted from

the lag weathering of lateritic products remaining on the paleo-shelf surface during the drop in sea level (Last Glacial Maximum). In contrast, the muddy material resulted from fine-grained sediment being passed from the estuaries to the deeper areas as suspended matter.

The heavy minerals in the study area were diverse, but the most common and valuable placers were ilmenite and zircon. Gold placers were only distributed locally and at a shallow grade. The placers are concentrated along with the present and paleo-shoreline zones and/or incised channels. The grain size of the ilmenite decreases in the same direction as the longshore current, implying that these heavy minerals may have originated from the Triassic-Cretaceous weathering of ilmenite-, zircon- and gold-containing granite and granitoid in central Vietnam.

Acknowledgements

This work was completed under the support of the National project entitled “establishing the scientific basis for master planning, surveying, and exploration of the marine mineral resources from 0 to 200 m of water depth, SE Vietnam; Code: KC.09.18/16-20.

We also thank Vietnam Petroleum Institute (VPI) for providing us additional magnetic and gravity data (Vietnam Gravity and Magnetic Modelling Project) to improve the quality of our work.

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Appendix 1. Results of the grain-size analysis

Sample ID	X	Y	Mean	So	Sk	K	Name	Abbreviation
SP-1	1118726,2	766721,6	327,46	2,27	0,43	1,32	Gravelly Sand	gS
SP-2	1112493,5	771438,5	504,41	2,77	0,50	0,65	Gravelly Sand	gS
SP-3	1109036,4	774042,3	252,18	1,88	0,58	1,79	Gravelly Sand	gS
SP-4	1106324,8	776034,5	393,09	2,39	0,55	0,84	Gravelly Sand	gS
SP-5	1102018,0	779273,4	471,53	2,71	0,58	0,74	Gravelly Sand	gS
SP-6	1099447,6	781225,6	540,95	2,82	0,52	0,56	Gravelly Sand	gS
SP-7	1097011,4	783036,8	473,57	2,71	0,49	1,06	Gravelly Sand	gS
SP-8	1092600,6	786311,6	336,31	1,46	-0,11	0,78	Slightly Gravelly Sand	gS
SP-9	1085599,4	791687,2	235,39	1,96	0,65	2,35	Gravelly Sand	gS
SP-10	1078002,5	797527,0	406,54	2,46	0,48	1,11	Gravelly Sand	gS
SP-11	1073055,4	801352,4	344,48	2,37	0,56	1,32	Gravelly Sand	gS
SP-12	1065876,8	806777,4	455,25	3,28	0,38	0,79	Gravelly Sand	gS
SP-13	1059494,3	809142,7	371,80	3,13	0,54	1,18	Gravelly Sand	gS
SP-14	1051265,9	818096,1	351,43	3,61	0,26	0,98	Gravelly Muddy Sand	gmS
SP-15	1045282,6	822961,0	212,00	2,74	0,33	1,47	Gravelly Sand	gS
SP-16	1039858,4	827389,0	300,85	2,81	0,55	1,36	Gravelly Sand	gS
SP-17	1037341,6	829407,8	254,31	2,98	0,35	1,35	Gravelly Sand	gS
SP-18	1033911,7	832189,1	324,11	3,45	0,48	1,15	Gravelly Sand	gS
SP-19	1031963,1	833757,6	236,40	2,12	0,42	2,28	Slightly Gravelly Sand	gS
SP-20	1029516,9	835761,2	249,55	2,16	0,45	2,05	Slightly Gravelly Sand	gS
SP-21	1025134,5	839343,2	213,12	2,69	0,30	1,75	Gravelly Sand	gS
SP-22	1018181,8	844791,1	183,76	3,00	0,24	1,47	Gravelly Muddy Sand	gmS
SP-23	1011580,4	850286,6	191,71	2,20	0,08	2,03	Slightly Gravelly Muddy Sand	gmS
SP-24	1004409,8	856103,8	174,46	1,93	0,04	2,54	Sand	S
SP-25	998432,3	861175,2	261,04	1,79	0,14	1,22	Slightly Gravelly Sand	gS
SP-26	991889,2	866614,0	540,95	2,02	0,05	1,69	Slightly Gravelly Sand	gS
SP-27	984855,7	872251,7	270,84	1,66	0,07	1,12	Slightly Gravelly Sand	gS
SP-28	952757,1	893072,9	236,36	1,46	0,06	1,05	Slightly Gravelly Sand	gS
SP-29	958734,8	887948,3	236,79	1,52	0,05	1,27	Slightly Gravelly Sand	gS
SP-30	965902,8	882146,3	239,57	1,47	-0,03	1,13	Slightly Gravelly Sand	gS
SP-31	972328,0	876261,4	264,24	1,68	0,22	1,26	Slightly Gravelly Sand	gS
SP-32	979944,4	870411,6	265,66	1,66	0,17	1,15	Slightly Gravelly Sand	gS
SP-33	986928,8	864747,0	309,47	1,68	-0,14	0,81	Sand	S
SP-34	993491,0	859329,4	245,72	1,71	0,23	1,24	Slightly Gravelly Sand	gS
SP-35	999468,9	854264,2	227,80	1,97	0,26	1,67	Slightly Gravelly Sand	gS
SP-36	1006673,8	848468,1	224,00	2,56	0,30	1,64	Slightly Gravelly Sand	gS
SP-37	1013048,2	842983,8	269,27	2,80	0,17	1,65	Gravelly Sand	gS
SP-38	1020225,7	837533,9	247,49	2,71	0,47	2,08	Gravelly Sand	gS
SP-39	1026874,1	832053,7	250,20	2,51	0,46	1,68	Gravelly Sand	gS
SP-40	1029515,7	829865,3	285,81	2,60	0,57	1,45	Gravelly Sand	gS
SP-41	1033132,1	826938,9	295,34	2,60	0,61	1,59	Gravelly Sand	gS
SP-42	1037456,7	823381,0	268,95	2,69	0,47	2,06	Gravelly Sand	gS
SP-43	1041054,7	820443,7	219,99	1,74	0,58	2,16	Slightly Gravelly Sand	gS
SP-44	1045943,9	816345,1	259,16	3,31	0,41	2,05	Gravelly Muddy Sand	gmS
SP-45	1060111,9	805307,6	523,53	3,06	0,44	0,52	Gravelly Sand	gS
SP-46	1067300,3	799912,8	693,01	2,50	0,22	0,70	Gravelly Sand	gS
SP-47	1072242,9	795873,9	315,14	2,04	0,33	1,53	Gravelly Sand	gS
SP-48	1079849,4	790043,0	520,24	2,26	0,44	1,11	Gravelly Sand	gS
SP-49	1086861,2	784786,1	244,15	1,34	-0,14	0,77	Sand	S
SP-50	1094032,1	779404,8	310,19	3,26	0,38	1,72	Gravelly Muddy Sand	gmS

Sample ID	X	Y	Mean	So	Sk	K	Name	Abbreviation
SP-51	1099249,8	775454,3	239,09	1,93	0,64	2,29	Gravelly Sand	gS
SP-52	1106039,0	770350,5	292,33	2,18	0,59	1,69	Gravelly Sand	gS
SP-53	1111468,0	766245,5	427,64	2,82	0,42	0,92	Gravelly Sand	gS
SP-54	1115622,0	763064,9	325,20	2,34	0,46	1,42	Gravelly Sand	gS
SP-55	1078002,5	797527,0	391,62	2,51	0,43	1,35	Gravelly Sand	gS
SP-56	998432,3	861175,2	253,33	2,00	0,12	1,44	Slightly Gravelly Sand	gS
SP-57	1026874,1	832053,7	238,28	2,52	0,26	1,80	Slightly Gravelly Sand	gS
SP-58	1045943,9	816345,1	237,86	3,13	0,34	2,44	Gravelly Muddy Sand	gmS
SP-59	1067300,3	799912,8	677,90	2,56	0,34	0,76	Gravelly Sand	gS
SP-60	1115622,0	763064,9	369,33	2,87	0,50	1,59	Gravelly Sand	gS
SP-61	1032400,99	832050,43	287,24	2,59	0,56	1,89	Gravelly Sand	gS
SP-62	1035295,18	829702,19	272,81	3,31	0,38	0,96	Gravelly Sand	gS
SP-63	1036062,29	827580,88	294,81	3,33	0,42	1,23	Gravelly Sand	gS
SP-64	1031431,6	831356,48	234,66	2,24	0,42	2,32	Slightly Gravelly Sand	gS
SP-65	1029287,26	833106,14	264,87	2,41	0,57	2,13	Gravelly Sand	gS
SP-66	1029747,7	831172,31	389,13	3,09	0,46	0,99	Gravelly Sand	gS
SP-67	1034970,39	826975,74	240,39	3,16	0,37	1,36	Gravelly Sand	gS
SP-68	1036891,08	825357,62	282,92	3,53	0,43	1,43	Gravelly Sand	gS
SP-69	1027129,79	830317,21	315,47	3,36	0,42	1,16	Gravelly Sand	gS
SP-70	1031129,02	827008,63	248,70	3,24	0,35	1,53	Gravelly Muddy Sand	gmS
SP-71	1033247,04	825272,11	346,90	3,10	0,52	1,13	Gravelly Sand	gS
SP-72	1035299,28	823601,38	303,54	2,84	0,61	2,14	Gravelly Sand	gS
SP-73	1032687,94	824338,08	249,26	2,40	0,53	2,69	Gravelly Sand	gS
SP-74	1030951,43	825693,09	297,08	2,67	0,56	1,55	Gravelly Sand	gS
SP-75	1028471,63	827692,71	236,93	1,79	0,53	1,82	Slightly Gravelly Sand	gS
SP-76	1025610,34	828422,83	231,22	1,76	0,44	1,79	Slightly Gravelly Sand	gS
SP-77	1034042,94	821621,49	243,38	2,23	0,56	2,63	Gravelly Sand	gS
SP-78	1031431,6	831356,48	263,61	2,27	0,50	2,03	Slightly Gravelly Sand	gS
SP-79	1104166,88	771548,85	238,41	1,92	0,71	2,20	Gravelly Sand	gS
SP-80	1032687,94	824338,08	262,53	2,41	0,52	2,57	Gravelly Sand	gS
SP-81	1032477,45	822851,52	244,38	2,21	0,54	2,72	Gravelly Sand	gS
SP-82	1027399,47	828547,81	227,53	1,87	0,33	2,18	Slightly Gravelly Sand	gS
SP-83	1031030,36	830146,19	369,33	2,87	0,50	1,59	Gravelly Sand	gS
SP-84	1100947,74	778528,29	382,77	2,48	0,80	1,07	Gravelly Sand	gS
SP-85	1105781,09	774858,79	287,89	2,25	0,40	2,04	Gravelly Sand	gS
SP-86	1105955,3	773227,91	232,40	1,82	0,73	1,07	Gravelly Sand	gS
SP-87	1102523,02	775792,85	471,83	2,60	0,52	0,88	Gravelly Sand	gS
SP-88	1097704,51	779410,45	401,25	2,28	0,40	1,08	Gravelly Sand	gS
SP-89	1096158,88	779154,69	550,93	2,62	0,30	0,76	Gravelly Sand	gS
SP-90	1098379,1	777490,46	214,21	1,58	0,58	1,70	Slightly Gravelly Sand	gS
SP-91	1103230,98	773769,07	344,44	2,19	0,41	1,29	Gravelly Sand	gS
SP-92	1105264,02	772275,34	229,69	1,77	0,66	1,85	Slightly Gravelly Sand	gS
SP-93	1094457,57	777010,46	475,76	2,60	0,57	1,37	Gravelly Sand	gS
SP-94	1097771,22	774490	321,48	2,30	0,39	1,56	Gravelly Sand	gS
SP-95	1101547,27	771615,56	446,70	2,71	0,62	1,11	Gravelly Sand	gS
SP-96	1103576,61	770125,53	370,55	2,87	0,56	2,03	Gravelly Sand	gS
SP-97	1099508,67	771320,9	479,46	2,77	0,68	0,76	Gravelly Sand	gS
SP-98	1097801,8	772595,94	258,20	2,04	0,63	2,21	Gravelly Sand	gS
SP-99	1095792,85	774098,96	419,12	3,09	0,53	1,48	Gravelly Sand	gS
SP-100	1093565,22	775794,71	269,21	1,94	0,44	2,17	Gravelly Sand	gS
SP-101	1028432,17	830731,6	377,54	3,01	0,55	1,02	Gravelly Sand	gS
SP-102	1104323,48	772974,95	225,70	1,91	0,15	2,66	Slightly Gravelly Sand	gS
SP-103	1034905,44	831417,33	318,80	3,58	0,24	1,03	Gravelly Muddy Sand	gmS

Sample ID	X	Y	Mean	So	Sk	K	Name	Abbreviation
SP-104	1028392,7	826160,1	236,52	1,76	0,52	1,69	Slightly Gravelly Sand	gS
SP-105	1034292,89	824509,1	237,08	2,26	0,44	2,47	Gravelly Muddy Sand	gmS
SP-106	1099859,87	779367,82	369,33	2,87	0,50	1,59	Gravelly Sand	gS
SP-107	1032437,98	827482,22	321,09	2,55	0,50	1,49	Gravelly Sand	gS
SP-108	1030602,8	828929,31	351,34	3,05	0,53	0,96	Gravelly Sand	gS
SP-109	1028432,17	830731,6	312,76	3,29	0,45	0,98	Gravelly Sand	gS
SP-110	1027813,86	829738,37	362,15	3,27	0,38	0,94	Gravelly Sand	gS
SP-111	1030070,01	827870,3	354,39	3,50	0,45	0,81	Gravelly Sand	gS
SP-112	1032207,76	826166,68	318,02	2,58	0,45	1,53	Gravelly Sand	gS
SP-113	1034292,89	824509,1	234,43	2,20	0,50	2,65	Gravelly Sand	gS
SP-114	1034805,96	822555,53	290,53	2,50	0,65	2,20	Gravelly Sand	gS
SP-115	1033746,94	823397,48	289,96	2,63	0,62	2,11	Gravelly Sand	gS
SP-116	1031839,41	824989,27	260,12	2,32	0,55	2,54	Gravelly Sand	gS
SP-117	1029734,55	826660	226,55	1,72	0,47	1,81	Slightly Gravelly Sand	gS
SP-118	1027399,47	828547,81	225,99	1,91	0,43	2,16	Slightly Gravelly Sand	gS
SP-119	1026425,97	829396,33	240,57	2,05	0,58	2,26	Gravelly Sand	gS
SP-120	1028392,7	826160,1	226,79	1,79	0,37	1,99	Slightly Gravelly Sand	gS
SP-121	1032933,77	833004,19	252,70	2,10	0,55	2,06	Slightly Gravelly Sand	gS
SP-122	1031131,49	834378,94	306,83	2,77	0,60	1,56	Gravelly Sand	gS
SP-123	1030138,26	834069,79	325,25	2,45	0,49	1,31	Gravelly Sand	gS
SP-124	1031217	833037,08	270,16	2,27	0,56	1,88	Gravelly Sand	gS
SP-125	1033604,7	831129,55	239,40	3,12	0,35	1,04	Gravelly Muddy Sand	gmS
SP-126	1034492,69	830425,74	288,04	3,62	0,34	0,84	Gravelly Sand	gS
SP-127	1036268,67	828906,3	252,38	3,13	0,33	1,18	Gravelly Sand	gS
SP-128	1038215,66	827380,26	268,04	3,29	0,39	0,97	Gravelly Sand	gS
SP-129	1037318,63	826521,87	219,19	2,91	0,32	1,52	Gravelly Muddy Sand	gmS
SP-130	1035029,59	828376,78	253,01	2,96	0,40	1,69	Gravelly Sand	gS
SP-131	1033293,09	829804,14	233,19	3,06	0,36	1,38	Gravelly Sand	gS
SP-132	1032365,63	830507,96	291,19	2,41	0,65	1,48	Gravelly Sand	gS
SP-133	1030010,81	832422,07	347,85	3,25	0,41	1,05	Gravelly Sand	gS
SP-134	1028596,6	832172,12	339,20	3,35	0,40	0,96	Gravelly Sand	gS
SP-135	1031030,36	830146,19	449,61	3,25	0,36	0,67	Gravelly Sand	gS
SP-136	1033181,26	828488,61	344,96	2,76	0,39	1,27	Gravelly Sand	gS
SP-137	1033957,43	827719,02	247,99	2,45	0,44	2,16	Gravelly Sand	gS
SP-138	1035911	826166,68	239,07	2,89	0,37	1,84	Gravelly Sand	gS
SP-139	1035746,56	824844,57	310,08	3,50	0,47	1,13	Gravelly Sand	gS
SP-140	1033996,89	826225,89	289,37	2,64	0,56	1,87	Gravelly Sand	gS
SP-141	1102189,43	774617,88	401,26	2,37	0,49	1,01	Gravelly Sand	gS
SP-142	1104323,48	772974,95	228,69	1,87	0,64	2,29	Gravelly Sand	gS
SP-143	1104166,88	771548,85	269,90	2,00	0,78	1,86	Gravelly Sand	gS
SP-144	1102146,81	773085,21	493,73	2,83	0,54	0,59	Gravelly Sand	gS
SP-145	1100369,52	774445,52	240,72	1,43	-0,24	1,05	Slightly Gravelly Sand	gS
SP-146	1098145,59	776109,75	520,20	2,94	0,44	0,72	Gravelly Sand	gS
SP-147	1095845,67	777857,4	498,05	2,94	0,53	0,48	Gravelly Sand	gS
SP-148	1095584,36	776154,24	498,22	2,64	0,55	1,08	Gravelly Sand	gS
SP-149	1096675,93	775307,29	513,68	2,97	0,43	0,80	Gravelly Sand	gS
SP-150	1098708,99	773767,22	241,26	1,38	-0,18	0,86	Slightly Gravelly Sand	gS
SP-151	1100501,1	772453,25	458,79	2,91	0,50	0,82	Gravelly Sand	gS
SP-152	1102642,56	770837,2	252,07	2,20	0,51	2,42	Gravelly Sand	gS
SP-153	1102679,62	768924,61	246,27	2,04	0,31	2,10	Slightly Gravelly Sand	gS
SP-154	1100351,91	770679,67	482,82	2,84	0,45	0,41	Gravelly Sand	gS
SP-155	1098667,29	771956,57	234,33	1,99	0,65	2,37	Gravelly Sand	gS
SP-156	1096897,41	773255,72	484,52	3,00	0,56	0,89	Gravelly Sand	gS

Sample ID	X	Y	Mean	So	Sk	K	Name	Abbreviation
SP-157	1094697,57	774944,05	262,19	1,96	0,58	1,84	Gravelly Sand	gS
SP-158	1038303,65	828660,45	232,32	3,01	0,36	1,09	Gravelly Muddy Sand	gmS
SP-159	1036290,88	830258,01	259,94	3,21	0,38	0,98	Gravelly Sand	gS
SP-160	1034905,44	831417,33	314,17	3,70	0,24	0,85	Gravelly Muddy Sand	gmS
SP-161	1107456,12	775059,09	369,33	2,87	0,50	1,59	Gravelly Sand	gS
SP-162	1105117,15	776833,93	495,18	2,79	0,52	0,64	Gravelly Sand	gS
SP-163	1103313,91	778157,16	375,88	2,04	0,25	1,53	Gravelly Sand	gS
SP-164	1100830,52	780062,33	408,60	2,76	0,75	1,02	Gravelly Sand	gS
SP-165	1098372,15	781890,59	512,67	3,33	0,29	0,80	Gravelly Muddy Sand	gmS
SP-166	1098756,7	780174,46	493,24	3,12	0,22	1,11	Gravelly Sand	gS
SP-167	1099859,87	779367,82	418,17	2,84	0,72	1,03	Gravelly Sand	gS
SP-168	1101889,2	777842,57	500,67	2,72	0,54	0,36	Gravelly Sand	gS
SP-169	1103672,06	776500,81	479,49	3,19	0,33	0,52	Gravelly Muddy Sand	gmS
SP-170	1104709,89	775681,65	380,25	2,45	0,49	1,30	Gravelly Sand	gS
SP-171	1106748,49	774165,67	404,48	2,51	0,61	0,89	Gravelly Sand	gS
SP-172	1104591,28	774239,8	220,29	1,60	0,46	1,67	Slightly Gravelly Sand	gS
SP-173	1103382,95	775173,85	492,26	2,67	0,51	0,78	Gravelly Sand	gS
SP-174	1101681,64	776448,91	209,41	2,51	0,26	2,61	Gravelly Muddy Sand	gmS
SP-175	1099935,85	777772,15	205,06	1,63	0,25	2,89	Slightly Gravelly Sand	gS
SP-176	1098823,89	778624,65	210,18	1,50	0,45	1,66	Slightly Gravelly Sand	gS
SP-177	1096989,14	780007,2	520,62	2,68	0,35	0,71	Gravelly Sand	gS
SP-178	1097278,25	778313,31	362,21	2,22	0,35	1,34	Gravelly Sand	gS
SP-179	1099483,65	776649,07	213,76	1,37	0,50	1,08	Slightly Gravelly Sand	gS
SP-180	1100391,76	775970,77	235,33	2,33	0,55	2,83	Gravelly Sand	gS
SP-181	1053068,86	788534,84	351,99	2,47	0,60	1,32	Gravelly Sand	gS
SP-182	1036177,07	782540,32	308,70	1,95	0,45	1,68	Slightly Gravelly Sand	gS
SP-183	1020311,63	794736,06	268,74	1,92	0,46	1,81	Slightly Gravelly Sand	gS
SP-184	1068964,1	776394,25	285,96	1,96	0,65	2,05	Gravelly Sand	gS
SP-185	1064990,73	779504,78	327,22	2,24	0,57	1,56	Gravelly Sand	gS
SP-186	1075802,19	752343,49	183,22	1,32	0,08	1,46	Sand	S
SP-187	1083722,05	746283,8	216,98	1,62	0,40	1,45	Slightly Gravelly Sand	gS
SP-188	1004206,52	806820,44	202,23	1,27	0,03	1,14	Slightly Gravelly Sand	gS
SP-189	1016368,3	797759,51	245,76	1,79	0,44	2,17	Slightly Gravelly Sand	gS
SP-190	1060972,03	782707,79	210,14	1,25	-0,04	1,25	Slightly Gravelly Sand	gS
SP-191	1029519,91	806311,86	371,22	2,98	0,56	0,93	Gravelly Sand	gS
SP-192	1056019,41	767457,28	194,07	1,27	0,11	1,15	Slightly Gravelly Sand	gS
SP-193	992343,52	815893,18	233,28	1,36	0,20	1,26	Slightly Gravelly Sand	gS
SP-194	1072972,76	773473,18	230,23	1,47	0,27	1,64	Slightly Gravelly Sand	gS
SP-195	993836,52	833666,57	278,26	1,96	0,45	1,55	Slightly Gravelly Sand	gS
SP-196	1052085,02	770533,53	194,58	1,71	-0,20	2,62	Slightly Gravelly Sand	gS
SP-197	1071826,75	755328,6	188,08	1,39	0,26	1,84	Slightly Gravelly Sand	gS
SP-198	1059926,42	764409,29	201,18	1,32	0,28	1,29	Slightly Gravelly Sand	gS
SP-199	1067897,5	758313,97	191,35	1,43	0,25	1,90	Slightly Gravelly Sand	gS
SP-200	1088891,82	761417,45	263,25	1,57	0,24	1,52	Slightly Gravelly Sand	gS
SP-201	1079771,39	749328,52	191,80	1,35	0,25	1,41	Slightly Gravelly Sand	gS
SP-202	976461,46	828027,76	263,54	1,86	0,52	1,80	Slightly Gravelly Sand	gS
SP-203	1000244,74	809815,68	364,74	2,53	0,60	1,32	Gravelly Sand	gS
SP-204	1048073,22	773519,35	245,11	2,20	0,54	1,67	Slightly Gravelly Sand	gS
SP-205	1080864,94	767295,19	222,96	1,48	0,38	1,70	Slightly Gravelly Sand	gS
SP-206	1108663,3	746173,4	408,14	2,27	0,49	0,90	Gravelly Sand	gS
SP-207	1041209,63	797630,66	291,82	2,91	0,32	1,30	Slightly Gravelly Sand	gS
SP-208	1044082,84	776481,18	296,90	2,45	0,70	2,26	Gravelly Sand	gS
SP-209	1031515,54	748211,21	227,14	1,65	0,51	1,73	Slightly Gravelly Sand	gS

Sample ID	X	Y	Mean	So	Sk	K	Name	Abbreviation
SP-210	1057011,92	785514,3	213,50	1,30	0,17	1,16	Sand	S
SP-211	1009679,12	821529,35	280,38	2,56	0,43	1,13	Slightly Gravelly Sand	gS
SP-212	1063876,78	761392,08	187,53	1,35	0,27	1,93	Slightly Gravelly Sand	gS
SP-213	1017609,9	815460,89	269,00	2,31	0,53	2,29	Slightly Gravelly Sand	gS
SP-214	1040126,75	779498,27	223,71	1,39	0,13	1,14	Slightly Gravelly Sand	gS
SP-215	996277,58	812903,2	262,43	2,27	0,25	2,84	Slightly Gravelly Sand	gS
SP-216	997747,45	830576,83	248,44	2,30	0,37	3,12	Gravelly Sand	gS
SP-217	1096785,04	755277,86	201,10	1,35	0,28	1,32	Slightly Gravelly Sand	gS
SP-218	1021573,79	812422,92	290,95	2,14	0,62	2,04	Gravelly Sand	gS
SP-219	1087654,09	743197,13	264,28	1,83	0,41	1,49	Slightly Gravelly Sand	gS
SP-220	1076943,73	770430,97	225,06	1,52	0,39	2,36	Slightly Gravelly Sand	gS
SP-221	1033352,22	803725,52	243,90	1,71	0,46	1,92	Slightly Gravelly Sand	gS
SP-222	984374,96	821988,67	287,26	1,70	0,34	1,78	Slightly Gravelly Sand	gS
SP-223	1102560,3	750380,22	456,51	3,03	0,56	0,81	Gravelly Sand	gS
SP-224	1084901,53	764375,68	225,78	1,43	0,28	1,42	Slightly Gravelly Sand	gS
SP-225	1035430,56	745225,25	196,91	1,35	0,38	1,60	Slightly Gravelly Sand	gS
SP-226	1025467,02	809386,06	446,79	3,19	0,49	0,76	Gravelly Sand	gS
SP-227	1091651,12	740159,42	227,65	1,50	0,32	1,42	Slightly Gravelly Sand	gS
SP-228	1012157,68	800800,83	219,22	1,39	0,23	1,58	Slightly Gravelly Sand	gS
SP-229	1013664,41	818487,04	306,61	2,88	0,49	0,80	Gravelly Sand	gS
SP-230	1001735,96	827566,49	235,80	1,70	0,39	2,41	Slightly Gravelly Sand	gS
SP-231	1008183,75	803828,68	285,96	1,77	0,43	1,55	Slightly Gravelly Sand	gS
SP-232	1037270,08	800671,78	323,35	2,05	0,53	2,07	Gravelly Sand	gS
SP-233	988342,58	818975,95	263,79	1,56	0,33	1,84	Slightly Gravelly Sand	gS
SP-234	1045214,18	794638,45	226,40	1,34	0,06	1,15	Slightly Gravelly Sand	gS
SP-235	1104672,55	749137,74	271,36	1,79	0,49	1,85	Slightly Gravelly Sand	gS
SP-236	1092779,37	758262,42	215,85	1,49	0,33	1,86	Slightly Gravelly Sand	gS
SP-237	1049066,02	791770,07	247,75	1,51	0,31	1,39	Slightly Gravelly Sand	gS
SP-238	1104149,89	900165,77	107,16	3,36	-0,70	3,61	Muddy Sand	mS
SP-239	1107847,26	897776,01	76,98	4,28	-0,43	3,15	Slightly Gravelly Muddy Sand	gmS
SP-240	1111142,26	895177,57	166,45	6,99	-0,20	1,71	Gravelly Muddy Sand	gmS
SP-241	1115108,88	892084,26	55,29	6,35	-0,46	1,23	Muddy Sand	mS
SP-242	1119076,52	889083,04	174,16	6,49	-0,56	1,26	Slightly Gravelly Muddy Sand	gmS
SP-243	1123043,54	886021,44	80,41	10,67	-0,41	0,76	Slightly Gravelly Muddy Sand	gmS
SP-244	1127050,99	882996,6	32,53	8,45	-0,11	0,67	Gravelly Sand	gS
SP-245	1130975,47	879979,35	58,91	8,91	-0,40	0,72	Muddy Sand	mS
SP-246	1135016,84	876955,36	88,53	9,78	-0,42	0,93	Slightly Gravelly Muddy Sand	gmS
SP-247	1138935,06	873921,11	25,39	5,97	-0,45	0,70	Sandy Mud	sM
SP-248	1142859,64	870902,64	38,16	7,42	-0,46	0,81	Slightly Gravelly Muddy Sand	gmS
SP-249	1146762,23	867836,28	34,45	5,59	-0,61	1,01	Muddy Sand	mS
SP-250	1150825,38	864820,63	90,85	11,50	-0,18	0,86	Slightly Gravelly Muddy Sand	gmS
SP-251	1154784,31	861837,15	83,76	8,85	-0,23	1,14	Slightly Gravelly Muddy Sand	gmS
SP-252	1158743,14	858839,07	114,89	8,04	-0,10	1,39	Slightly Gravelly Muddy Sand	gmS
SP-253	1162748,11	857022,39	96,49	6,29	-0,19	3,14	Slightly Gravelly Muddy Sand	gmS

Sample ID	X	Y	Mean	So	Sk	K	Name	Abbreviation
SP-254	1166688,31	852811	187,15	4,44	0,25	3,87	Slightly Gravelly Muddy Sand	gmS
SP-255	1157829,59	840632	94,27	5,62	-0,21	2,94	Slightly Gravelly Muddy Sand	gmS
SP-256	1153860,82	843655,05	92,64	5,82	-0,49	1,53	Muddy Sand	mS
SP-257	1149923,21	846708,88	104,95	7,87	-0,34	1,74	Slightly Gravelly Muddy Sand	gmS
SP-258	1145988,24	849714,58	45,13	7,38	-0,44	0,77	Muddy Sand	mS
SP-259	1142010,4	852733,5	21,72	5,24	-0,30	0,69	Sandy Mud	sM
SP-260	1138081,85	856057,22	114,74	9,12	-0,56	1,20	Slightly Gravelly Muddy Sand	gmS
SP-261	1134048,49	858748,91	136,83	8,73	-0,46	1,21	Slightly Gravelly Muddy Sand	gmS
SP-262	1130081,97	861958,51	133,14	10,29	-0,27	0,99	Gravelly Muddy Sand	gmS
SP-263	1126173,92	864863,39	169,77	9,34	-0,27	1,23	Gravelly Muddy Sand	gmS
SP-264	1122144,43	867922,51	43,39	7,96	-0,39	0,72	Slightly Gravelly Muddy Sand	gmS
SP-265	1118175,94	870926,74	73,65	10,43	-0,43	0,80	Gravelly Sand	gS
SP-266	1114232,42	873961,79	61,71	8,85	-0,51	0,97	Slightly Gravelly Muddy Sand	gmS
SP-267	1110286,39	877046,27	57,36	9,06	-0,37	0,93	Slightly Gravelly Muddy Sand	gmS
SP-268	1093829,71	889479,81	292,93	5,19	0,15	1,50	Gravelly Muddy Sand	gmS
SP-269	1112518,74	856392,64	120,66	7,61	-0,36	1,59	Slightly Gravelly Muddy Sand	gmS
SP-270	1116524,8	853371,51	353,26	5,53	-0,10	1,35	Gravelly Muddy Sand	gmS
SP-271	1120505,79	850299,42	372,98	4,42	0,25	0,80	Gravelly Muddy Sand	gmS
SP-272	1124468,63	847252,5	167,45	7,25	-0,18	1,92	Gravelly Muddy Sand	gmS
SP-273	1128410,2	844227,75	342,18	6,31	-0,32	1,29	Gravelly Muddy Sand	gmS
SP-274	1132428,55	841184,58	177,10	4,67	-0,26	2,14	Slightly Gravelly Muddy Sand	gmS
SP-275	1136428,69	838160,49	271,56	5,01	-0,10	1,71	Gravelly Muddy Sand	gmS
SP-276	1138399,43	835186,86	93,75	7,52	-0,43	1,66	Slightly Gravelly Muddy Sand	gmS
SP-277	1144305,87	832084,9	196,82	3,28	-0,22	2,07	Muddy Sand	mS
SP-278	1148244,43	829032,82	107,30	7,75	-0,31	1,58	Slightly Gravelly Muddy Sand	gmS
SP-279	978409,16	807551,43	214,71	1,79	0,53	2,01	Sand	S
SP-280	1041860,56	759324,51	273,15	2,27	0,74	1,94	Gravelly Sand	gS
SP-281	1045888,33	756303,42	335,03	3,03	0,68	2,07	Gravelly Sand	gS
SP-282	1053728,77	750230,86	230,06	2,01	0,66	2,26	Gravelly Sand	gS
SP-283	1057710,32	747150,82	257,78	1,72	0,26	1,38	Slightly Gravelly Sand	gS
SP-284	1061695,63	744159,82	259,58	2,07	0,69	1,64	Gravelly Sand	gS
SP-285	1065677,69	741126,72	217,62	1,94	0,69	4,08	Gravelly Sand	gS
SP-286	1069607,44	738067,12	179,75	1,54	0,29	6,64	Slightly Gravelly Sand	gS
SP-287	1073639,53	735135,53	178,71	1,36	0,19	1,32	Gravelly Sand	gS
SP-288	1027508,91	751277,69	284,28	2,26	0,73	1,57	Gravelly Sand	gS
SP-289	1023508,65	754363,04	211,40	1,58	0,55	2,06	Slightly Gravelly Sand	gS
SP-290	1019522,73	757277,87	260,71	2,06	0,84	1,94	Gravelly Sand	gS
SP-291	1015605,54	760348,55	207,91	1,58	0,75	5,48	Slightly Gravelly Sand	gS
SP-292	1011653,95	763319,22	179,98	1,15	0,32	2,04	Slightly Gravelly Sand	gS
SP-293	1007759,41	766534,45	421,10	2,75	0,60	1,27	Gravelly Sand	gS
SP-294	1003752,04	769414,96	262,91	1,72	0,19	1,58	Slightly Gravelly Sand	gS
SP-295	999795,52	772530,93	222,55	1,44	0,65	0,99	Slightly Gravelly Sand	gS

Sample ID	X	Y	Mean	So	Sk	K	Name	Abbreviation
SP-296	995847,23	775491,55	236,50	1,93	0,60	1,88	Gravelly Sand	gS
SP-297	991856,55	778535,52	213,59	1,45	0,50	1,26	Slightly Gravelly Sand	gS
SP-298	987874,98	781555,52	225,87	1,49	0,65	1,08	Slightly Gravelly Sand	gS
SP-299	984175,46	784454,87	223,73	1,68	0,77	1,73	Slightly Gravelly Sand	gS
SP-300	981148,64	786830,2	285,29	2,28	0,85	1,68	Gravelly Sand	gS
SP-301	977051,11	789947,29	243,88	2,03	0,82	1,86	Gravelly Sand	gS
SP-302	973045,42	793003,13	474,80	3,02	0,52	0,79	Gravelly Sand	gS
SP-303	965150,78	799078,87	455,11	2,95	0,64	0,99	Gravelly Sand	gS
SP-304	965150,78	799078,87	351,99	2,47	0,60	1,32	Gravelly Sand	gS
SP-305	961144,88	802084,31	232,28	1,52	0,64	1,00	Slightly Gravelly Sand	gS
SP-306	957256,7	805205,67	223,65	1,38	0,59	0,74	Slightly Gravelly Sand	gS
SP-307	953330,7	808193,21	259,17	1,68	0,22	1,36	Slightly Gravelly Sand	gS
SP-308	949269,48	811185,31	255,25	1,67	-0,30	1,28	Slightly Gravelly Sand	gS
SP-309	958691,78	822721,53	280,58	2,27	0,65	2,02	Gravelly Sand	gS
SP-310	962604,95	819754,01	318,05	3,19	0,65	2,03	Gravelly Sand	gS
SP-311	966572,67	816679,5	265,47	1,95	0,42	1,52	Slightly Gravelly Sand	gS
SP-312	970522,69	813697,43	375,98	2,52	0,55	1,17	Gravelly Sand	gS
SP-313	974465,55	810578,29	203,43	1,39	0,17	0,91	Sand	S
SP-314	978409,16	807551,43	214,71	1,79	0,53	2,01	Sand	S
SP-315	982383,34	804494,3	400,98	2,47	0,59	0,93	Gravelly Sand	gS
SP-316	986379,59	801504,81	330,73	2,31	0,57	1,16	Gravelly Sand	gS
SP-317	990372,59	798485,31	237,72	1,77	0,44	2,01	Slightly Gravelly Sand	gS
SP-318	994316,25	795439,2	236,33	1,78	0,43	2,02	Slightly Gravelly Sand	gS
SP-319	998313,8	792607,18	207,74	1,57	0,39	1,47	Slightly Gravelly Sand	gS
SP-320	1002349,05	789457,57	286,89	1,90	0,37	1,70	Slightly Gravelly Sand	gS
SP-321	1006201,29	786499,31	209,90	1,61	0,44	1,76	Sand	S
SP-322	1010176,1	783476,54	300,81	1,91	0,30	1,58	Slightly Gravelly Sand	gS
SP-323	1014150,76	780423,78	467,62	2,21	0,34	0,82	Sand	S
SP-324	1018094,76	777371,8	214,35	1,32	0,13	0,97	Sand	S
SP-325	1022039,26	774381,46	278,49	2,17	0,57	1,47	Slightly Gravelly Sand	gS
SP-326	1026168,06	771359,86	326,09	2,12	0,41	1,03	Slightly Gravelly Sand	gS
SP-327	1029887,99	768323,33	241,79	1,83	0,51	2,17	Slightly Gravelly Sand	gS
SP-328	1033946,21	765297,26	287,52	2,24	0,49	1,29	Gravelly Sand	gS
SP-329	1037875,67	762309,26	179,98	1,63	0,55	2,61	Slightly Gravelly Sand	gS
SP-330	1059136,48	727076,11	197,15	1,58	0,40	1,27	Sand	S
SP-331	1055220,46	729997,61	189,79	1,56	0,47	1,39	Sand	S
SP-332	1051274,93	733102,9	195,47	1,34	0,10	0,91	Sand	S
SP-333	1047236,94	736148,34	186,61	1,88	0,73	2,42	Gravelly Sand	gS
SP-334	1043352,34	739132,39	350,49	3,23	0,75	0,97	Gravelly Sand	gS
SP-335	1039406,77	742178,44	350,73	2,86	0,65	1,19	Gravelly Sand	gS
SP-336	945248,17	814165,38	297,45	2,02	0,43	1,38	Slightly Gravelly Sand	gS
SP-337	941301,78	817292,32	347,58	2,44	0,51	1,76	Gravelly Sand	gS
SP-338	924781,19	811005,07	351,13	2,66	0,63	1,27	Gravelly Sand	gS
SP-339	928695,75	808068,24	323,42	2,11	0,53	1,66	Gravelly Sand	gS
SP-340	932664,94	805027,41	295,39	2,18	0,54	1,46	Slightly Gravelly Sand	gS
SP-341	936603,41	801984,25	270,92	2,28	0,65	1,46	Slightly Gravelly Sand	gS
SP-342	940599,95	798886,09	192,53	1,57	0,41	2,03	Sand	S
SP-343	944541,89	795886,77	212,95	1,77	0,53	1,88	Slightly Gravelly Sand	gS
SP-344	948477,7	792884,94	208,68	1,44	0,24	1,33	Sand	S
SP-345	952471,56	789825,09	216,70	1,43	0,18	1,11	Sand	S
SP-346	956419,54	786790,55	275,96	2,24	0,61	2,00	Gravelly Sand	gS
SP-347	960416,88	783774,55	196,27	1,36	0,26	1,15	Sand	S
SP-348	968054,15	778052,36	232,22	1,85	0,37	1,85	Slightly Gravelly Sand	gS

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SP-349	971999,55	775059,64	208,67	1,57	0,34	1,57	Sand	S
SP-350	975944,61	772006,3	188,27	1,36	0,26	1,02	Sand	S
SP-351	979951,21	768953,1	191,57	1,34	0,22	0,99	Sand	S
SP-352	983896,51	765916,13	201,11	1,71	0,49	1,94	Slightly Gravelly Sand	gS
SP-353	987842,09	762910,27	223,28	1,39	0,12	1,15	Sand	S
SP-354	991787,45	759859,1	204,76	1,50	0,30	1,01	Sand	S
SP-355	995763,82	756838,85	189,32	1,63	0,43	2,32	Sand	S
SP-356	999697,15	753804,14	266,08	2,38	0,66	2,08	Gravelly Sand	gS
SP-357	1007604,02	747736,13	182,24	1,30	0,17	0,93	Sand	S
SP-358	1011574,83	744757,83	187,91	1,47	0,40	1,26	Sand	S
SP-359	1015505,34	741707,04	187,91	1,47	0,40	1,26	Sand	S
SP-360	1019445,01	738632,34	375,89	1,97	0,59	1,87	Gravelly Sand	gS
SP-361	1023514,95	735737,56	303,92	1,61	0,48	2,01	Slightly Gravelly Sand	gS
SP-362	1031407,3	729624,52	609,63	3,13	0,72	0,87	Gravelly Sand	gS
SP-363	1035350,65	726582,62	374,83	2,10	0,59	1,95	Gravelly Sand	gS
SP-364	1039324,79	723531,97	342,21	1,64	0,38	1,42	Slightly Gravelly Sand	gS
SP-365	1104529,8	862582,9	235,18	1,89	0,47	1,25	Slightly Gravelly Sand	gS
SP-366	1140436,7	816105,1	293,04	2,34	0,46	1,21	Slightly Gravelly Sand	gS
SP-367	1136494,4	819183,3	338,79	2,71	0,38	0,87	Gravelly Sand	gS
SP-368	1132429,2	822260,1	297,84	2,18	0,44	0,83	Sand	S
SP-369	1128488,5	825162,8	286,94	2,19	0,42	1,36	Sand	S
SP-370	1116682,3	834209,6	263,43	2,36	0,51	1,37	Slightly Gravelly Sand	gS
SP-371	1112467,9	837406,8	363,97	2,54	0,40	0,67	Sand	S
SP-372	1100973,3	846156	252,33	1,93	0,55	1,35	Sand	S
SP-373	1096735,5	849459,7	277,62	2,49	0,57	1,20	Slightly Gravelly Sand	gS
SP-374	1092735,2	852517,7	482,36	3,17	0,24	0,73	Gravelly Sand	gS
SP-375	1084752,5	858547	229,25	1,83	0,48	1,20	Sand	S
SP-376	1080432,4	861912	243,33	2,65	0,41	1,01	Sand	S
SP-377	1076569,6	864849,1	193,90	2,09	0,55	1,16	Sand	S
SP-378	1072600	867873,2	228,23	2,39	0,64	0,83	Sand	S
SP-379	1068576,2	871005,3	167,92	1,81	0,58	2,83	Sand	S
SP-380	1055608,8	861779,2	158,11	1,77	0,53	2,08	Sand	S
SP-381	1058765,2	859544,5	169,31	1,90	0,58	1,81	Sand	S
SP-382	1062694,2	856374,8	219,52	2,58	0,70	1,07	Slightly Gravelly Sand	gS
SP-383	1082418,6	841751,8	310,08	2,86	0,54	0,80	Gravelly Sand	gS
SP-384	1090319,6	835684,9	215,25	1,75	0,56	1,27	Sand	S
SP-385	1094258,9	832593	373,91	2,84	0,61	0,84	Gravelly Sand	gS
SP-386	1098247,8	829547	316,53	2,34	0,51	1,15	Gravelly Sand	gS
SP-387	1102127,8	826682,4	343,28	2,47	0,47	0,89	Gravelly Sand	gS
SP-388	1105999,4	823565,5	314,09	2,23	0,39	1,33	Slightly Gravelly Sand	gS
SP-389	1109938,4	820415,1	257,16	2,20	0,62	1,32	Slightly Gravelly Sand	gS
SP-390	1114174,4	817460,7	284,05	2,31	0,54	1,25	Slightly Gravelly Sand	gS
SP-391	1118123,9	814436,4	335,91	2,59	0,56	0,83	Gravelly Sand	gS
SP-392	1122030,5	811425,2	309,02	2,27	0,38	1,21	Slightly Gravelly Sand	gS
SP-393	1125848,2	808433,7	258,38	2,17	0,54	0,89	Sand	S
SP-394	1129985	805345,7	236,96	1,67	0,37	1,23	Sand	S
SP-395	1133851,3	802266,6	297,93	2,15	0,45	1,22	Sand	S
SP-396	1126436,1	789134,6	342,28	1,76	0,32	1,08	Sand	S
SP-397	1122441,1	792009,2	342,34	2,37	0,44	1,11	Gravelly Sand	gS
SP-398	1118594	794910,6	260,42	1,68	0,25	1,24	Sand	S
SP-399	1114644,4	798042	504,86	3,07	0,42	0,81	Gravelly Sand	gS
SP-400	1110528	801068,8	259,45	1,54	0,20	1,39	Sand	S
SP-401	1106621,3	804167,5	319,81	2,20	0,53	2,17	Gravelly Sand	gS

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SP-402	1102910,5	807149,4	375,12	2,61	0,53	1,00	Gravelly Sand	gS
SP-403	1098828,3	810202,1	260,18	2,37	0,57	1,17	Slightly Gravelly Sand	gS
SP-404	1094788,7	813197,2	429,17	2,39	0,37	0,88	Gravelly Sand	gS
SP-405	1090847,6	816191,9	272,85	1,97	0,50	1,62	Sand	S
SP-406	1086888,7	819248,4	366,27	2,57	0,43	0,79	Gravelly Sand	gS
SP-407	1083663	821750,1	342,90	2,34	0,42	0,84	Sand	S
SP-408	1079940,5	824393,8	299,28	2,34	0,50	1,06	Slightly Gravelly Sand	gS
SP-409	1071064,6	831330,9	248,40	2,01	0,56	0,76	Slightly Gravelly Sand	gS
SP-410	1067145,6	834350,3	285,00	2,52	0,48	0,80	Sand	S
SP-411	1063267,3	837107,5	271,31	2,38	0,41	0,96	Sand	S
SP-412	1059301,7	840064,3	180,06	2,04	0,38	1,49	Sand	S
SP-413	1055282,1	843171,8	194,54	2,33	0,54	1,50	Sand	S
SP-414	1051324,9	846035,1	244,18	2,75	0,55	0,79	Slightly Gravelly Sand	gS
SP-415	1047448,4	849304,3	222,63	2,32	0,63	1,07	Sand	S
SP-416	1043694,7	852212,6	170,74	2,00	0,57	1,34	Sand	S
SP-417	1031005,6	842823,7	209,47	1,93	0,32	1,12	Sand	S
SP-418	1035000,4	839629,8	253,11	2,28	0,57	1,31	Sand	S
SP-419	1038925,4	836892,2	228,03	2,09	0,55	1,63	Sand	S
SP-420	1042891,3	833892,2	236,77	2,06	0,46	1,43	Sand	S
SP-421	1046777,2	830890,3	204,28	1,49	0,30	1,29	Sand	S
SP-422	1050843,4	827747	336,30	2,17	0,40	0,87	Sand	S
SP-423	1054695,4	824725,2	346,30	2,83	0,53	0,90	Gravelly Sand	gS
SP-424	1059509,5	821283,7	309,47	2,19	0,31	0,83	Sand	S
SP-425	1063160,6	818121,3	380,11	2,35	0,36	0,91	Slightly Gravelly Sand	gS
SP-426	1067389,2	815253,8	366,61	2,15	0,34	0,91	Slightly Gravelly Sand	gS
SP-427	1071396,5	812019,5	364,12	2,38	0,54	1,01	Gravelly Sand	gS
SP-428	1075442,3	808971,6	250,89	1,69	0,44	1,75	Sand	S
SP-429	1079344,5	806023,1	731,14	2,82	0,11	0,81	Gravelly Sand	gS
SP-430	1083228	803029,5	378,63	2,44	0,55	1,00	Gravelly Sand	gS
SP-431	1087115	800085,3	508,91	2,78	0,48	1,08	Gravelly Sand	gS
SP-432	1091156	797177,1	484,14	2,75	0,32	0,83	Gravelly Sand	gS
SP-433	1095118,2	794007,8	382,03	1,77	0,22	1,10	Sand	S
SP-434	1099103,5	791024,9	283,81	1,83	0,41	1,76	Sand	S
SP-435	1102997,3	787738,6	316,07	2,35	0,57	1,88	Gravelly Sand	gS
SP-436	1111095,8	781957,8	357,31	2,34	0,56	1,81	Gravelly Sand	gS
SP-437	1114973,1	778886,8	581,16	3,50	0,63	0,82	Gravelly Sand	gS
SP-438	1118861,7	776069,2	276,79	1,77	0,34	1,39	Sand	S
SP-439	1114127,5	760925,1	395,68	2,95	0,53	0,88	Gravelly Sand	gS
SP-440	1110169,1	763933,5	217,38	1,62	0,37	1,47	Sand	S
SP-441	1106258,1	766741	224,77	1,79	0,37	2,33	Gravelly Sand	gS
SP-442	1102364,7	769829,3	304,22	2,22	0,52	1,78	Gravelly Sand	gS
SP-443	1098282,8	772776,4	321,89	2,59	0,70	1,03	Gravelly Sand	gS
SP-444	1094456,9	775822,8	369,92	3,24	0,78	2,16	Gravelly Sand	gS
SP-445	1090464,8	778837,5	228,43	1,54	0,33	1,44	Sand	S
SP-446	1086518,9	781855,5	336,08	2,21	0,60	2,07	Gravelly Sand	gS
SP-447	1082579,3	784874	280,77	1,92	0,45	2,34	Gravelly Sand	gS
SP-448	1078500,2	787729,6	250,55	2,00	0,64	2,41	Gravelly Sand	gS
SP-449	1074631,8	790800,6	445,26	2,75	0,64	1,17	Gravelly Sand	gS
SP-450	1070603,4	793827,7	478,14	2,77	0,57	0,70	Gravelly Sand	gS
SP-451	1066833,9	796941,8	489,74	2,39	0,24	0,80	Gravelly Sand	gS
SP-452	1062867,3	799994	285,13	1,99	0,54	1,57	Sand	S
SP-453	1058750,3	803069,4	386,71	3,14	0,57	0,99	Gravelly Sand	gS
SP-454	1054671,9	806352,6	263,71	2,68	0,53	1,04	Gravelly Sand	gS

Sample ID	X	Y	Mean	So	Sk	K	Name	Abbreviation
SP-455	1046956,6	811986,2	399,63	2,76	0,45	0,83	Gravelly Sand	gS
SP-456	1042928,6	815014,3	272,56	2,15	0,55	1,28	Sand	S
SP-457	1038949,5	817999,9	209,33	1,83	0,57	1,63	Sand	S
SP-458	1035159,8	821198,2	323,33	2,69	0,48	0,84	Gravelly Sand	gS
SP-459	1031115,1	824054,1	266,57	2,11	0,44	1,47	Sand	S
SP-460	1027165,4	827221,3	301,67	2,48	0,57	0,75	Sand	S
SP-461	1023251,3	830242,1	198,78	1,68	0,42	1,80	Sand	S
SP-462	1019207,4	833179	191,39	1,77	0,39	1,32	Sand	S
SP-463	1015219,2	836146,6	233,36	2,04	0,29	1,22	Sand	S
SP-464	1011402,6	839397,4	192,02	1,81	0,30	1,08	Sand	S
SP-465	1015219,2	836146,6	256,21	2,03	0,50	1,46	Sand	S
SP-466	1110528	801068,8	240,70	1,66	0,06	1,60	Sand	S
SP-467	1082418,6	841751,8	291,43	2,52	0,55	1,03	Sand	S
SP-468	1080432,4	861912	243,58	2,18	0,56	1,28	Sand	S
SP-469	1107032,4	784814,5	292,32	2,34	0,46	1,22	Gravelly Sand	gS
SP-470	1015219,2	836146,6	288,73	1,99	0,56	1,51	Sand	S
SP-471	1031115,1	824054,1	255,68	2,65	0,43	0,91	Sand	S
SP-472	1031115,1	824054,1	309,73	2,35	0,49	1,10	Sand	S
SP-473	1078500,2	787729,6	276,87	2,16	0,67	2,37	Gravelly Sand	gS
SP-474	1082418,6	841751,8	310,18	2,86	0,54	0,81	Gravelly Sand	gS
SP-475	1106621,3	804167,5	315,76	2,28	0,55	2,49	Gravelly Sand	gS
SP-476	1074944,2	828373,4	261,21	2,80	0,15	2,26	Slightly Gravelly Sand	gS
SP-477	1100728,2	865423,8	216,16	5,59	-0,10	1,74	Gravelly Muddy Sand	gmS
SP-478	1078460,1	844735,8	96,52	5,62	-0,24	1,82	Slightly Gravelly Muddy Sand	gmS
SP-479	1084762,4	877432,3	145,84	7,03	-0,10	1,77	Gravelly Muddy Sand	gmS
SP-480	1109012,4	859238,6	143,83	5,77	-0,32	2,22	Slightly Gravelly Muddy Sand	gmS
SP-481	1107032,4	784814,5	242,62	1,66	0,37	2,12	Slightly Gravelly Sand	gS
SP-482	1104632	843398,2	327,95	5,93	0,01	1,35	Gravelly Muddy Sand	gmS
SP-483	1086370,6	838716,5	372,60	4,58	0,20	1,24	Gravelly Muddy Sand	gmS
SP-484	1080946,1	880328	708,26	4,41	-0,17	1,04	Gravelly Sand	gS
SP-485	1088796	855511,7	296,46	6,55	-0,03	1,20	Gravelly Muddy Sand	gmS
SP-486	1124540,8	828291,7	286,94	2,19	0,42	1,36	Sand	S
SP-487	1066671,4	853425	226,05	6,59	-0,14	1,31	Gravelly Muddy Sand	gmS
SP-488	1120585,1	831223,2	291,88	3,70	0,17	2,40	Gravelly Muddy Sand	gmS
SP-489	1074944,2	828373,4	253,98	2,84	0,15	2,15	Slightly Gravelly Sand	gS
SP-490	1107032,4	784814,5	224,48	1,61	0,10	2,17	Slightly Gravelly Sand	gS
SP-491	1088855,7	874235,3	204,73	6,66	-0,07	1,28	Gravelly Muddy Sand	gmS
SP-492	1092787	871452,4	147,72	7,63	-0,20	1,31	Gravelly Muddy Sand	gmS
SP-493	1096753,4	868486,7	246,09	5,75	-0,01	1,33	Gravelly Muddy Sand	gmS
SP-494	1108617,3	840369,6	320,60	4,26	0,17	1,73	Gravelly Muddy Sand	gmS
SP-495	1161585,643	772089,4023	156,95	1,47	0,35	1,59	Sand	S
SP-496	1161585,643	772089,4023	218,96	1,63	0,48	1,41	Sand	S
SP-497	1158756,768	768212,932	175,72	1,47	0,28	1,12	Sand	S
SP-498	1158226,986	766396,6528	174,65	1,55	0,43	1,98	Sand	S
SP-499	1158226,986	766396,6528	200,14	1,67	0,52	1,91	Sand	S
SP-500	1157977,087	764313,4805	158,24	1,35	0,31	1,59	Sand	S
SP-501	1157977,087	761987,402	266,71	1,64	0,33	0,98	Sand	S
SP-502	1157977,087	761987,402	400,39	2,55	0,03	0,64	Sand	S
SP-503	1157067,452	756825,4458	172,29	1,45	0,26	0,66	Sand	S
SP-504	1155628,015	755142,1144	164,24	1,76	0,44	1,41	Sand	S
SP-505	1154858,332	753590,733	259,28	1,58	0,19	0,91	Sand	S

Sample ID	X	Y	Mean	So	Sk	K	Name	Abbreviation
SP-506	1153568,834	751907,4016	234,04	1,72	0,53	1,27	Sand	S
SP-507	1153568,834	751907,4016	697,82	1,71	-0,12	1,02	Sand	S
SP-508	1153568,834	751907,4016	280,44	1,83	0,35	0,92	Sand	S
SP-509	1153568,834	751907,4016	169,41	1,40	0,29	1,47	Sand	S
SP-510	1149940,283	748938,5678	527,68	2,26	-0,32	0,66	Sand	S
SP-511	1148520,852	744020,5236	396,38	2,22	0,08	0,76	Sand	S
SP-512	1148520,852	744020,5236	196,11	1,72	0,51	1,21	Sand	S
SP-513	1150709,976	742203,2385	182,81	1,38	0,21	1,18	Sand	S
SP-514	1150709,976	742203,2385	182,81	1,38	0,21	1,18	Sand	S
SP-515	1150709,976	742203,2385	178,55	1,49	0,44	1,74	Sand	S
SP-516	1150709,976	742203,2385	105,09	1,25	0,00	1,30	Sand	S
SP-517	1149800,351	737816,9771	191,21	1,47	0,38	1,46	Sand	S
SP-518	1151489,678	737551,0898	197,79	1,64	0,46	1,39	Sand	S
SP-519	1151489,678	737551,0898	197,68	1,64	0,46	1,40	Sand	S
SP-520	1149430,497	736775,395	308,04	1,86	0,24	1,02	Sand	S
SP-521	1148780,759	735490,9068	199,16	1,53	0,42	1,17	Sand	S
SP-522	1147741,171	733940,5149	178,61	1,36	0,12	1,00	Sand	S
SP-523	1146441,685	731990,2903	118,58	1,46	0,24	1,09	Sand	S
SP-524	1144882,303	730063,0551	144,65	1,36	0,27	1,06	Sand	S
SP-525	1142823,122	729021,4648	138,79	1,31	0,25	1,09	Sand	S
SP-526	1141653,59	728379,7155	232,55	1,44	0,23	0,97	Sand	S
SP-527	1153893,668	793280,9913	257,85	2,52	0,56	0,67	Sand	S
SP-528	1165257,175	780078,2319	456,66	2,22	0,23	0,90	Slightly Gravelly Sand	gS
SP-529	1165257,175	780078,2319	844,50	2,01	-0,25	0,70	Sand	S
SP-530	1165257,175	780078,2319	802,11	2,10	-0,02	0,78	Gravelly Sand	gS
SP-531	1156084,822	786214,7892	183,57	1,96	0,37	1,55	Sand	S
SP-532	1151404,675	789138,6337	253,90	2,30	0,57	0,87	Slightly Gravelly Sand	gS
SP-533	1147092,373	791822,5571	244,77	1,74	0,47	1,77	Slightly Gravelly Sand	gS
SP-534	1138748,671	797683,2332	170,97	2,11	0,42	1,90	Slightly Gravelly Sand	gS
SP-535	1161501,68	776494,654	510,60	1,94	0,02	0,97	Slightly Gravelly Sand	gS
SP-536	1153065,017	782369,3233	207,52	2,31	0,43	1,24	Slightly Gravelly Sand	gS
SP-537	1148660,753	785235,1747	213,47	2,15	0,61	0,97	Sand	S
SP-538	1140076,161	791059,8659	442,91	3,14	0,30	1,21	Gravelly Sand	gS
SP-539	1150392,071	778100,0126	202,87	1,95	0,17	2,04	Slightly Gravelly Sand	gS
SP-540	1145897,856	781148,7981	334,35	2,76	0,00	0,97	Slightly Gravelly Sand	gS
SP-541	1133054,94	789656,4067	327,18	2,38	0,31	1,22	Gravelly Sand	gS
SP-542	1133054,94	789656,4067	334,37	2,01	-0,08	1,63	Sand	S
SP-543	1157130,409	767183,3476	150,00	2,22	0,07	0,86	Slightly Gravelly Muddy Sand	gmS
SP-544	1142908,044	776241,7374	463,26	1,86	0,11	0,90	Slightly Gravelly Sand	gS
SP-545	1135339,045	775480,0358	304,58	1,96	0,34	0,85	Sand	S
SP-546	1136850,457	768161,9397	170,51	1,42	0,39	1,21	Sand	S
SP-547	1131893,436	758882,6107	180,38	1,55	0,35	1,69	Sand	S
SP-548	1127488,173	761747,4727	210,07	1,54	0,10	1,95	Sand	S
SP-549	1127488,173	761747,4727	231,87	1,32	0,05	0,90	Sand	S
SP-550	1123634,697	764333,4437	304,57	1,88	-0,38	1,76	Muddy Sand	mS
SP-551	1123634,697	764333,4437	422,73	1,66	0,31	1,16	Sand	S
SP-552	1119599,299	767287,27	199,65	1,38	0,12	1,25	Sand	S
SP-553	1145802,925	744082,4911	175,25	2,09	0,07	1,66	Slightly Gravelly Muddy Sand	gmS
SP-554	1141394,682	746669,4599	320,47	2,31	0,04	1,07	Slightly Gravelly Sand	gS
SP-555	1137173,352	749438,3649	151,25	1,66	0,46	2,59	Slightly Gravelly Sand	gS
SP-556	1132859,05	752209,2572	122,84	1,47	-0,25	1,51	Muddy Sand	mS

Sample ID	X	Y	Mean	So	Sk	K	Name	Abbreviation
SP-557	1128728,681	754796,2259	219,32	2,20	0,18	1,51	Slightly Gravelly Sand	gS
SP-558	1124325,437	757933,9758	226,19	1,83	0,05	1,91	Sand	S
SP-559	1119735,251	760707,8696	216,14	1,85	0,16	1,68	Slightly Gravelly Sand	gS
SP-560	1147229,375	737043,286	103,83	1,57	0,22	1,69	Muddy Sand	mS
SP-561	1142545,228	739722,2124	359,05	1,85	-0,28	2,21	Slightly Gravelly Sand	gS
SP-562	1138690,743	742305,1901	101,11	1,51	-0,30	1,69	Muddy Sand	mS
SP-563	1134374,461	744801,1989	115,53	1,39	-0,17	1,42	Muddy Sand	mS
SP-564	1130156,13	748117,8836	285,60	2,54	-0,23	0,86	Sand	S
SP-565	1125751,876	751163,6676	253,51	1,83	0,39	1,00	Sand	S
SP-566	1121532,535	754299,4221	361,73	2,21	-0,23	1,41	Sand	S
SP-567	1121532,535	754299,4221	626,02	2,17	0,15	0,99	Sand	S
SP-568	1117311,205	757070,3143	240,95	1,95	0,51	1,46	Sand	S
SP-569	1144339,523	732316,1496	198,11	2,24	-0,12	1,37	Slightly Gravelly Sand	gS
SP-570	1140207,154	734808,1674	264,88	1,65	0,46	1,71	Slightly Gravelly Sand	gS
SP-571	1135984,824	737576,0582	86,48	1,80	0,67	0,97	Muddy Sand	mS
SP-572	1131210,715	740621,8505	108,29	1,98	0,39	0,75	Muddy Sand	mS
SP-573	1127081,356	743481,7154	153,85	1,83	0,26	2,69	Slightly Gravelly Muddy Sand	gmS
SP-574	1122402,208	746802,3911	214,50	1,65	0,36	1,13	Slightly Gravelly Sand	gS
SP-575	1118365,8	749754,2137	307,35	1,95	0,39	1,26	Sand	S
SP-576	1114877,19	751971,3316	254,13	1,49	0,09	1,19	Slightly Gravelly Sand	gS
SP-577	1137507,234	730900,7092	318,73	2,56	0,26	1,22	Gravelly Sand	gS
SP-578	1133374,865	733393,7248	70,51	1,42	0,65	0,87	Sandy Mud	sM
SP-579	1134620,371	726445,4795	67,23	1,47	0,74	3,95	Sandy Mud	sM
SP-580	1131132,761	728842,5217	64,65	1,37	0,69	3,31	Sandy Mud	sM

Appendix 2. Results of the major heavy mineral anlysis

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
CP09-1002	1140436,52	816104,61	110,2	40,8	0
CP09-1003	1136494,22	819182,8	53,8	27,1	0
CP09-1004	1132429,02	822259,61	43,8	19,4	0
CP09-1005	1128488,32	825162,3	110	42,8	0
CP09-1006	1124540,62	828291,21	51,8	21,9	0
CP09-1007	1120584,92	831222,7	89,5	12,3	0
CP09-1008	1116682,12	834209,11	67,4	28,3	0
CP09-1009	1112467,72	837406,3	98,6	33,9	0
CP09-1010	1108617,12	840369,11	88,7	27,6	0
CP09-1011	1104631,83	843397,71	37,6	16,4	0
CP09-1012	1100973,13	846155,51	115,6	50,9	0
CP09-1013	1096735,33	849459,21	78,8	61,2	0
CP09-1014	1092735,03	852517,22	34,9	15,2	0
CP09-1015	1088795,83	855511,22	55,3	21,4	0
CP09-1016	1084752,33	858546,51	11,2	3,3	0
CP09-1017	1080432,23	861911,52	103,5	41	0
CP09-1018	1076569,43	864848,61	43,5	18,5	0
CP09-1019	1072599,83	867872,72	41,8	14,1	0
CP09-1020	1068576,03	871004,81	27,5	18,8	0
CP09-1021	1055608,63	861778,73	82,7	72,1	0
CP09-1022	1058765,03	859544,02	123,4	44,9	0
CP09-1023	1062694,03	856374,32	38	10,4	0
CP09-1024	1066671,23	853424,51	100,4	20,5	0

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
CP09-1025	1070638,03	850353,22	8,3	0,9	0
CP09-1027	1078459,93	844735,32	40,9	23,8	0
CP09-1028	1082418,42	841751,32	69,9	38,9	0
CP09-1029	1086370,42	838716,01	85,4	34,4	0
CP09-1030	1090319,42	835684,41	92,9	53,1	0
CP09-1031	1094258,72	832592,51	57,3	22,1	0
CP09-1032	1098247,62	829546,51	75,7	22,8	0
CP09-1033	1102127,62	826681,91	88,3	34,3	0
CP09-1034	1105999,22	823565,01	159,7	52,6	0
CP09-1035	1109938,22	820414,6	105,6	55,7	0
CP09-1036	1114174,22	817460,21	124,2	46,8	0
CP09-1037	1118123,72	814435,9	142,1	62,8	0
CP09-1038	1122030,32	811424,7	82,1	22,9	0
CP09-1039	1125848,02	808433,21	165,7	73,8	0
CP09-1040	1129984,82	805345,21	92,6	53,9	0
CP09-1041	1133851,12	802266,11	165,4	70,3	0
CP09-1042	1126435,91	789134,11	157	28,7	0
CP09-1043	1122440,91	792008,71	243,5	89,5	0
CP09-1044	1118593,82	794910,11	138,6	54,8	0
CP09-1045	1114644,22	798041,51	215,1	66,9	0
CP09-1046	1110527,82	801068,31	212,8	57,3	0
CP09-1047	1106621,12	804167,01	357,8	109,3	0
CP09-1048	1102910,32	807148,9	346,2	96,2	0
CP09-1049	1098828,12	810201,61	145,9	38,2	0
CP09-1050	1094788,52	813196,72	100,6	24,2	0
CP09-1051	1090847,42	816191,41	77	40,7	0
CP09-1052	1086888,52	819247,91	80,5	26,9	0
CP09-1053	1083662,82	821749,61	75,5	40,7	0
CP09-1054	1079940,32	824393,31	55,6	31,6	0
CP09-1055	1074944,02	828372,91	161	67,7	0
CP09-1056	1071064,42	831330,42	39,7	26,6	0
CP09-1057	1067145,42	834349,81	34,5	27,6	0
CP09-1058	1063267,12	837107,01	24,4	15,7	0
CP09-1059	1059301,52	840063,82	16,2	7,5	0
CP09-1060	1055281,93	843171,32	27,1	24,9	0
CP09-1061	1051324,73	846034,62	22,9	16,2	0
CP09-1062	1047448,23	849303,82	88	72,2	0
CP09-1063	1043694,53	852212,12	106	89,3	0
CP09-1064	1031005,43	842823,22	81,6	44,3	0
CP09-1065	1035000,22	839629,32	507,3	123,7	0
CP09-1066	1038925,22	836891,72	379,7	80	0
CP09-1067	1042891,12	833891,72	164,1	41,9	0
CP09-1068	1046777,02	830889,83	130,8	22,6	0
CP09-1069	1050843,22	827746,52	62,1	30	0
CP09-1070	1054695,22	824724,72	177	77	0
CP09-1071	1059509,32	821283,22	37,9	26,4	0
CP09-1072	1063160,42	818120,81	114,3	41,1	0
CP09-1073	1067389,02	815253,31	7,9	3,1	0
CP09-1074	1071396,32	812019,01	168,6	69,8	0
CP09-1075	1075442,12	808971,11	81,9	35,7	0
CP09-1076	1079344,32	806022,61	75,5	26,6	0

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
CP09-1077	1083227,82	803029,01	133,3	56,3	0
CP09-1078	1087114,82	800084,81	160,4	47,5	0
CP09-1079	1091155,82	797176,62	120,1	35,5	0
CP09-1080	1095118,02	794007,31	420,9	187,3	0
CP09-1081	1099103,31	791024,42	55,1	23,5	0
CP09-1082	1102997,11	787738,1	156,3	94,5	0
CP09-1083	1107032,21	784814	178,2	55,8	0
CP09-1084	1111095,61	781957,3	79,8	34,5	0
CP09-1085	1114972,91	778886,3	144,7	46,7	0
CP09-1086	1118861,51	776068,71	135,5	44,7	0
CP09-1087	1114127,33	760924,62	312,7	70,1	0
CP09-1088	1110168,91	763933,01	154,3	79,4	0
CP09-1089	1106257,91	766740,5	127,8	62,2	0
CP09-1090	1102364,51	769828,8	107	42	0
CP09-1091	1098282,61	772775,91	149,5	61,1	0
CP09-1092	1094456,71	775822,31	263,2	156,2	0
CP09-1093	1090464,61	778837,01	86,7	64,9	0
CP09-1094	1086518,71	781855,01	110,6	46,3	0
CP09-1095	1082579,11	784873,51	80,4	39,2	0
CP09-1096	1078500,01	787729,11	142,1	53,6	0
CP09-1097	1074631,61	790800,11	115,1	33,2	0
CP09-1098	1070603,22	793827,21	231,6	57,9	0
CP09-1099	1066833,72	796941,31	107,6	43	0
CP09-1100	1062867,12	799993,51	79,4	47	0
CP09-1101	1058750,12	803068,92	233,3	89,8	0
CP09-1102	1054671,72	806352,12	103,3	58,9	0
CP09-1103	1050868,92	809105,62	62,3	7,7	0
CP09-1104	1046956,42	811985,72	130,3	65,6	0
CP09-1105	1042928,42	815013,82	615,4	193,5	0
CP09-1106	1038949,32	817999,42	483,7	214,7	0
CP09-1107	1035159,62	821197,72	141,3	29	0
CP09-1108	1031114,92	824053,62	73,3	25,5	0
CP09-1109	1027165,22	827220,82	255,8	115,9	0
CP09-1110	1023251,12	830241,62	193,1	58	0
CP09-1111	1019207,22	833178,53	217,1	82,4	0
CP09-1112	1015219,02	836146,13	341,1	66,9	0
CP09-1113	1011402,43	839396,93	339,7	127,4	0
CP09-984	1080945,93	880327,51	40,5	10	0
CP09-985	1084762,23	877431,81	35,6	16,1	0
CP09-986	1088855,53	874234,82	11	3,6	0
CP09-987	1092786,83	871451,92	17,1	6,7	0
CP09-988	1096753,23	868486,22	64,4	31,3	0
CP09-989	1100728,03	865423,31	98,7	24,1	0
CP09-990	1104529,63	862582,41	58,1	13,8	0
CP09-991	1109012,23	859238,11	54,7	11,4	0
CP09-1005	1128488,32	825162,3	197,4	80,4	0
CP09-1006	1124540,62	828291,21	48,7	36	0
CP09-1007	1120584,92	831222,7	63,2	13,4	0
CP09-1008	1116682,12	834209,11	10,6	17,5	0
CP09-1009	1112467,72	837406,3	407,8	94	0
CP09-1010	1108617,12	840369,11	145,7	42,5	0

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
CP09-1011	1104631,83	843397,71	9,2	29,4	0
CP09-1012	1100973,13	846155,51	87,9	14,3	0
CP09-1013	1096735,33	849459,21	215	106	0
CP09-1014	1092735,03	852517,22	123,7	33,7	0
CP09-1017	1080432,23	861911,52	257,1	38,3	0
CP09-1018	1076569,43	864848,61	299,1	13,1	0
CP09-1019	1072599,83	867872,72	103,9	16,7	0
CP09-1020	1068576,03	871004,81	0	125,9	0
CP09-1021	1055608,63	861778,73	0	260,9	0
CP09-1022	1058765,03	859544,02	131,8	52,8	0
CP09-1023	1062694,03	856374,32	0	38,6	0
CP09-1024	1066671,23	853424,51	184,2	32,6	0
CP09-1025	1070638,03	850353,22	0	0	0
CP09-1028	1082418,42	841751,32	70,4	101,2	0
CP09-1042	1126435,91	789134,11	224,5	77,1	0
CP09-1043	1122440,91	792008,71	187,8	141,4	0
CP09-1046	1110527,82	801068,31	412,2	79	0
CP09-1048	1102910,32	807148,9	71,3	247,4	0
CP09-1049	1098828,12	810201,61	223,2	141,4	0
CP09-1051	1090847,42	816191,41	61,2	68,7	0
CP09-1052	1086888,52	819247,91	64,3	58,9	0
CP09-1059	1059301,52	840063,82	19,6	19,6	0
CP09-1060	1055281,93	843171,32	0	33,7	0
CP09-1061	1051324,73	846034,62	0	62,4	0
CP09-1062	1047448,23	849303,82	89,4	31	0
CP09-1063	1043694,53	852212,12	0	102,4	0
CP09-1083	1107032,21	784814	60,8	85,1	0
CP09-1084	1111095,61	781957,3	67,2	43,2	0
CP09-1085	1114972,91	778886,3	26,9	43,2	0
CP09-1086	1118861,51	776068,71	184,7	26,3	0
CP09-1107	1035159,62	821197,72	163,7	157,1	0
CP09-1109	1027165,22	827220,82	334	107,9	0
CP09-1110	1023251,12	830241,62	0	51,2	0
CP09-1113	1011402,43	839396,93	112,9	164,9	0
CP09-986	1088855,53	874234,82	0	5,5	0
CP09-1003	1136494,22	819182,8	136,8	38,7	0
CP09-1004	1132429,02	822259,61	77,8	37,6	0
V?09-10	1068576,03	871004,81	0	141,5	0
V?09-11	1055608,63	861778,73	0	288,4	0
V?09-12	1058765,03	859544,02	32,6	105,6	0
V?09-13	1011402,43	839396,93	45,7	281,6	0
XN09-27	1080945,93	880327,51	38,2	10	0
XN09-28	1092786,83	871451,92	26,9	12	0
XN09-29	1108617,12	840369,11	89,6	27,8	0
XN09-30	1084752,33	858546,51	12,1	7,8	0
XN09-31	1055608,63	861778,73	121,4	69,4	0
XN09-32	1070638,03	850353,22	6,7	1,7	0
XN09-33	1098247,62	829546,51	72,2	25,6	0
XN09-34	1118123,72	814435,9	150,2	62,3	0
XN09-35	1094788,52	813196,72	99,4	29,5	0
XN09-36	1063267,12	837107,01	30,3	22	0

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
XN09-37	1095118,02	794007,31	544,5	195,1	0
XN09-38	1102997,11	787738,1	169,4	83,1	0
XN09-39	1094456,71	775822,31	263	158,8	0
CP10-1000	1144305,87	832084,9	1045,2	417	0
CP10-1001	1148244,43	829032,82	372,6	105,2	0
CP10-1001A	1153776,45	835039,14	199,4	52,1	0
CP10-1114	993836,52	833666,57	163,9	27,3	0
CP10-1115	997747,45	830576,83	403,8	102,1	0
CP10-1116	1001735,96	827566,49	569,7	93,3	0
CP10-1117	1005767,58	824559,38	480,3	115,3	0
CP10-1118	1009679,12	821529,35	452,2	80,4	0
CP10-1119	1013664,41	818487,04	788,3	194,9	0
CP10-1120	1017609,9	815460,89	1370	181,5	0
CP10-1121	1021573,79	812422,92	459	77,1	0
CP10-1122	1025467,02	809386,06	1262,4	308,6	0
CP10-1123	1029519,91	806311,86	521,3	193,1	0
CP10-1124	1033352,22	803725,52	373,8	87,4	0
CP10-1125	1037270,08	800671,78	452,5	85,4	0
CP10-1126	1041209,63	797630,66	186,2	46,7	0
CP10-1127	1045214,18	794638,45	338,3	87,5	0
CP10-1128	1049066,02	791770,07	545,7	147,6	0
CP10-1130	1057011,92	785514,3	64,6	28	0
CP10-1131	1060972,03	782707,79	161,4	59,1	0
CP10-1132	1064990,73	779504,78	105,2	51,7	0
CP10-1133	1068964,1	776394,25	277,3	114,5	0
CP10-1134	1072972,76	773473,18	169,5	59,7	0
CP10-1135	1076943,73	770430,97	286,1	89,6	0
CP10-1136	1080864,94	767295,19	266,4	87,2	0
CP10-1137	1084901,53	764375,68	180	60,7	0
CP10-1138	1088891,82	761417,45	219,3	60,3	0
CP10-1139	1092779,37	758262,42	132,3	58,2	0
CP10-1140	1096785,04	755277,86	224,4	98,9	0
CP10-1141	1102560,3	750380,22	234,9	96,2	0
CP10-1142	1104672,55	749137,74	103,4	38,9	0
CP10-1143	1108663,3	746173,4	126,1	38,5	0
CP10-1144	1091651,12	740159,42	119,3	36,3	0
CP10-1144A	1080968,66	736945,72	186,1	83	0
CP10-1145	1087654,09	743197,13	220,1	74,6	0
CP10-1146	1083722,05	746283,8	209,6	104,2	0
CP10-1147	1079771,39	749328,52	476,9	283,4	0
CP10-1148	1075802,19	752343,49	139,6	52,6	0
CP10-1149	1071826,75	755328,6	242	129,7	0
CP10-1150	1067897,5	758313,97	180,9	73,9	0
CP10-1151	1063876,78	761392,08	159,1	82,3	0
CP10-1152	1059926,42	764409,29	113,8	46,4	0
CP10-1153	1056019,41	767457,28	226,6	105,1	0
CP10-1154	1052085,02	770533,53	99,7	34,3	0
CP10-1155	1048073,22	773519,35	243	92,9	0
CP10-1156	1044082,84	776481,18	1133,5	463,1	0
CP10-1157	1040126,75	779498,27	111,8	26,8	0
CP10-1158	1036177,07	782540,32	233,5	39,1	0

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
CP10-1160	1028228,78	788629,53	667,7	142,4	0
CP10-1161	1024254,8	791682,63	310,4	61,8	0
CP10-1162	1020311,63	794736,06	149,1	38,2	0
CP10-1163	1016368,3	797759,51	461,3	91,4	0
CP10-1164	1012157,68	800800,83	174,7	30,8	0
CP10-1165	1008183,75	803828,68	711,3	122,3	0
CP10-1166	1004206,52	806820,44	746,6	141,8	0
CP10-1167	1000244,74	809815,68	1074,8	169,9	0
CP10-1168	996277,58	812903,2	617,1	86,9	0
CP10-1169	992343,52	815893,18	460,3	45,1	0
CP10-1170	988342,58	818975,95	223,5	30,9	0
CP10-1171	984374,96	821988,67	400,5	74,7	0
CP10-1172	980429,18	825035,39	866,5	168,7	0
CP10-1173	976461,46	828027,76	377,7	66,6	0
CP10-1174	958691,78	822721,53	298,5	87,6	0
CP10-1175	962604,95	819754,01	924,2	295,3	0
CP10-1176	966572,67	816679,5	527,2	141,3	0
CP10-1177	970522,69	813697,43	319,3	110,2	0
CP10-1178	974465,55	810578,29	239,5	25,5	0
CP10-1179	978409,16	807551,43	247,7	54,6	0
CP10-1180	982383,34	804494,3	241,3	42,7	0
CP10-1181	986379,59	801504,81	190,9	38,2	0
CP10-1182	990372,59	798485,31	191,6	37,4	0
CP10-1183	994316,25	795439,2	240,8	71,3	0
CP10-1184	998313,8	792607,18	783,3	191,8	0
CP10-1185	1002349,05	789457,57	3385,5	735,3	0
CP10-1186	1006201,29	786499,31	704,8	195,3	0
CP10-1187	1010176,1	783476,54	211,1	53,2	0
CP10-1188	1014150,76	780423,78	69,8	12,9	0
CP10-1189	1018094,76	777371,8	115,8	29,1	0
CP10-1190	1022039,26	774381,46	482	125,2	0
CP10-1191	1026168,06	771359,86	57,8	17,2	0
CP10-1192	1029887,99	768323,33	128,9	29,8	0
CP10-1193	1033946,21	765297,26	152,2	73,6	0
CP10-1194	1037875,67	762309,26	169,5	42	0
CP10-1195	1041860,56	759324,51	191,9	73,9	0
CP10-1196	1045888,33	756303,42	251,9	172,3	0
CP10-1197	1049756,58	753317,54	127,3	57,3	0
CP10-1198	1053728,77	750230,86	163,7	90,3	0
CP10-1199	1057710,32	747150,82	302,4	143,7	0
CP10-1200	1061695,63	744159,82	192,3	86,3	0
CP10-1201	1065677,69	741126,72	496	154,7	0
CP10-1202	1069607,44	738067,12	199,2	95	0
CP10-1203	1073639,53	735135,53	90,2	65,3	0
CP10-1204	1059136,48	727076,11	98,6	37,1	0
CP10-1205	1055220,46	729997,61	119	56,2	0
CP10-1206	1051274,93	733102,9	162,9	74,2	0
CP10-1207	1047236,94	736148,34	235	119,3	0
CP10-1208	1043352,34	739132,39	193,8	106,6	0
CP10-1209	1039406,77	742178,44	131,6	65	0
CP10-1210	1035430,56	745225,25	112	31,9	0

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
CP10-1211	1031515,54	748211,21	49,1	23,4	0
CP10-1212	1027508,91	751277,69	83,4	45,9	0
CP10-1213	1023508,65	754363,04	71,4	33,9	0
CP10-1214	1019522,73	757277,87	92,1	29,8	0
CP10-1215	1015605,54	760348,55	129,5	45,6	0
CP10-1216	1011653,95	763319,22	80,9	25,2	0
CP10-1217	1007759,41	766534,45	574,7	159,6	0
CP10-1218	1003752,04	769414,96	261,1	70	0
CP10-1219	999795,52	772530,93	201	42,5	0
CP10-1220	995847,23	775491,55	361,3	56,5	0
CP10-1221	991856,55	778535,52	183,6	38,8	0
CP10-1222	987874,98	781555,52	181,2	37,1	0
CP10-1223	984175,46	784454,87	791,3	191,6	0
CP10-1224	981148,64	786830,2	230,5	50,5	0
CP10-1225	977051,11	789947,29	511,2	115,9	0
CP10-1226	973045,42	793003,13	276,5	46,9	0
CP10-1227	969172,08	796070,79	453,2	101,6	0
CP10-1228	965150,78	799078,87	134,3	36,4	0
CP10-1229	961144,88	802084,31	54,5	7,1	0
CP10-1230	957256,7	805205,67	66,3	10,9	0
CP10-1231	953330,7	808193,21	78	11,5	0
CP10-1232	949269,48	811185,31	55,2	7,4	0
CP10-1233	945248,17	814165,38	530,9	134,9	0
CP10-1234	941301,78	817292,32	184,9	55,1	0
CP10-1234A	950863,02	820333,26	369,2	75,4	0
CP10-967	1157829,59	840632	659,5	214,4	0
CP10-968	1153860,82	843655,05	160,4	31,3	0
CP10-969	1149923,21	846708,88	573,7	193,3	0
CP10-970	1145988,24	849714,58	176,5	50,2	0
CP10-972	1138081,85	856057,22	145,1	17,1	0
CP10-973	1134048,49	858748,91	446,1	71,9	0
CP10-974	1130081,97	861958,51	102,5	40,4	0
CP10-975	1126173,92	864863,39	166,5	72,5	0
CP10-976	1122144,43	867922,51	207	80,4	0
CP10-977	1118175,94	870926,74	269	112,7	0
CP10-978	1114232,42	873961,79	259,8	103,5	0
CP10-979	1110286,39	877046,27	92,3	35	0
CP10-980	1106327,06	880033,9	73,9	20,1	0
CP10-980A	1103743,46	882174,85	106	18,7	0
CP10-981	1102344,54	883153,52	141,3	20	0
CP10-983	1093829,71	889479,81	268,6	69,8	0
CP10-992	1112518,74	856392,64	100,3	39,4	0
CP10-993	1116524,8	853371,51	86,2	39,1	0
CP10-994	1120505,79	850299,42	109,2	48,1	0
CP10-995	1124468,63	847252,5	144,8	55,2	0
CP10-996	1128410,2	844227,75	122,4	47,2	0
CP10-997	1132428,55	841184,58	211,4	72,6	0
CP10-998	1136428,69	838160,49	386,2	104,7	0
CP10-999	1138399,43	835186,86	163,7	42,8	0
CP10-1224	981148,64	786830,2	0	0	0
CP10-1000	1144305,87	832084,9	1211,5	274,7	0

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
CP10-1001	1148244,43	829032,82	573,8	116	0
CP10-1120	1017609,9	815460,89	1818,1	171,1	0
CP10-1121	1021573,79	812422,92	487,1	141,2	0
CP10-1122	1025467,02	809386,06	1012,6	122,6	0
CP10-1124	1033352,22	803725,52	410,8	153,1	0
CP10-1128	1049066,02	791770,07	565	97,9	0
CP10-1147	1079771,39	749328,52	558,8	399,5	0
CP10-1156	1044082,84	776481,18	2105,7	688	0
CP10-1160	1028228,78	788629,53	923,8	263	0
CP10-1167	1000244,74	809815,68	1918,5	521,5	0
CP10-1168	996277,58	812903,2	843,1	132,4	0
CP10-1172	980429,18	825035,39	1059,5	331,3	0
CP10-1184	998313,8	792607,18	843,2	242,9	0
CP10-1185	1002349,05	789457,57	3581,4	833,6	0
CP10-1186	1006201,29	786499,31	832,2	247,5	0
CP10-1190	1022039,26	774381,46	564,7	171,7	0
CP10-1217	1007759,41	766534,45	728,7	201,6	0
CP10-1223	984175,46	784454,87	1005	239,1	0
CP10-1225	977051,11	789947,29	589	192,5	0
CP10-1227	969172,08	796070,79	476	85,1	0
CP10-1233	945248,17	814165,38	522,9	109,9	0
CP10-967	1157829,59	840632	867,5	224,6	0
CP10-969	1149923,21	846708,88	649,3	171,4	0
LK2010-7SR	1156663,65	693621,61	333,8	75,7	0
LK2010-7SR	1156663,65	693621,61	224,4	113,3	0
LK2010-7SR	1156663,65	693621,61	291,9	92,2	0
TS10-20	997747,45	830576,83	288,6	82,4	0
TS10-21	1001735,96	827566,49	606,2	92,3	0
TS10-22	1005767,58	824559,38	335,1	70,7	0
TS10-23	1009679,12	821529,35	306,5	51	0
TS10-24	1017609,9	815460,89	1014,7	133,8	0
TS10-25	1021573,79	812422,92	340,6	45,8	0
TS10-26	1025467,02	809386,06	758,5	173,5	0
TS10-27	1029519,91	806311,86	484,8	198,7	0
TS10-28	1033352,22	803725,52	335,7	71,8	0
TS10-29	1016368,3	797759,51	438,6	92,7	0
TS10-30	992343,52	815893,18	372,4	40	0
TS10-31	980429,18	825035,39	792,6	155,6	0
TS10-32	962604,95	819754,01	629,9	207,7	0
TS10-33	966572,67	816679,5	282,9	78,2	0
TS10-34	970522,69	813697,43	319,6	83,6	0
TS10-35	978409,16	807551,43	151,6	43,3	0
TS10-36	982383,34	804494,3	194,5	37,5	0
TS10-37	981148,64	786830,2	182,1	47,8	0
TS10-38	977051,11	789947,29	367,6	80	0
TS10-39	973045,42	793003,13	283,7	56,3	0
TS10-40	969172,08	796070,79	423,3	85,1	0
TS10-41	965150,78	799078,87	123,8	33,9	0
TS10-42	945248,17	814165,38	483,2	118,3	0
TS10-43	941301,78	817292,32	169,8	43,6	0
TS10-44	950863,02	820333,26	326,3	73,4	0

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
TS10-71	1093829,71	889479,81	117	32,9	0
B91-208/1KT1/1	795790,8614	1176981,689	75	24	-
B91-208/1KT1/3	795790,8614	1176981,689	89	49	-
B91-208/1KT1/3	795790,8614	1176981,689	84	26	-
B91-208/4KT1/2	795790,8614	1176981,689	144	63	-
B91-208/4KT1/2	795790,8614	1176981,689	153	44	-
B91-208KT1/2	795790,8614	1176981,689	80	35	-
B91-209/1KT1/2	794240,8653	1176481,681	217	893	-
B91-209/1KT1/3	794240,8653	1176481,681	78	18	-
B91-209KT1/1	794240,8653	1176481,681	776	554	-
B91-209KT1/1	794240,8653	1176481,681	844	568	-
B91-211KT1/1	791065,8689	1174311,682	i	i	-
B91-211KT1/2	791065,8689	1174311,682	119	58	-
B91-212KT1/1	788990,8847	1173671,673	966	108	-
B91-212KT1/2	788990,8847	1173671,673	487	123	-
B91-212KT1/3	788990,8847	1173671,673	39	i	-
B91-214bKt1/1	784636,8892	1171331,679	2006	164	-
B91-214bKt1/2	784636,8892	1171331,679	118	48	-
B91-214bKt1/3	784636,8892	1171331,679	186	62	-
B91-214KT1/1	784336,8889	1171481,678	441	98	-
B91-214KT1/2	784336,8889	1171481,678	103	28	-
B91-214KT1/2	784336,8889	1171481,678	78	18	-
B91-215KT1/1	782784,8891	1170571,674	3714	319	-
B91-215KT1/2	782784,8891	1170571,674	163	41	-
B91-215KT1/3	782784,8891	1170571,674	500	169	-
B91-219KT1/1	775426,9078	1162541,688	460	129	-
B91-219KT1/2	775426,9078	1162541,688	48	49	-
B91-219KT1/3	775426,9078	1162541,688	1284	514	-
B91-219KT2	775426,9078	1162541,688	4	i	-
B91-225KT1/1	762084,9338	1158531,674	1627	164	-
B91-225KT1/3	762084,9338	1158531,674	46	i	-
B91-225KT2/2	762084,9338	1158531,674	5	i	-
B91-234KT1/1	744110,964	1149071,68	66	31	-
B91-234KT1/2	744110,964	1149071,68	142	14	-
B91-234KT1/4	744110,964	1149071,68	68	i	-
B91-235KT1/1	742292,9615	1151261,674	6451	1443	-
B91-235KT1/2	742292,9615	1151261,674	366	106	-
B91-235KT1/3	742292,9615	1151261,674	i	i	-
B91-238KT1/1	737638,974	1152041,665	1461	229	-
B91-238KT1/2	737638,974	1152041,665	913	1876	-
B91-238KT1/3	737638,974	1152041,665	292	11	-
B91-238KT1/4	737638,974	1152041,665	1083	i	-
B91-238KT2/2	737638,974	1152041,665	120	14	-
B91-238KT2/3	737638,974	1152041,665	93	54	-
B91-238KT2/4	737638,974	1152041,665	116	20	-
B91-206	798901,8618	1177041,687	14852	2413	-
B91-207	797403,864	1177171,69	831	310	-
B91-208	795790,8614	1176981,689	1041	305	-
B91-209	794240,8653	1176481,681	8342	1379	-
B91-210	792678,8715	1175621,676	546	29	-
B91-211	791065,8689	1174311,682	13715	411	-

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
B91-212	788990,8847	1173671,673	11248	1260	-
B91-213	786552,8771	1172381,675	370	29	-
B91-214	784336,8889	1171481,678	194637	76	-
B91-215	782784,8891	1170571,674	27691	2387	-
B91-216	781632,8869	1170061,677	84	21	-
B91-217	779172,8959	1167731,682	19162	5667	-
S1	777354,9017	1165381,69	948	240	-
S2	775426,9078	1162541,688	19222	8445	-
S3	772190,9169	1162141,689	173807	52	-
S4	770107,9177	1161371,676	302	74	-
S5	768312,9211	1159311,685	580	28	-
S6	766495,9246	1158781,683	10914	706	-
S7	764411,9194	1158531,674	642	18	-
S8	762084,9338	1158531,674	396189	-	-
S9	759919,9297	1158364,678	5236	1	-
S10	756920,9409	1157621,679	5805	39	-
S11	755236,9416	1156181,673	195	7	-
S12	753684,95	1155411,679	1737	598	-
S13	752000,9507	1154121,682	122923	11487	-
S14	749030,9542	1150491,681	27064	1	-
S15	747080,9522	1148291,679	1836	756	-
S16	744110,964	1149071,68	1264	122	-
S17	742292,9615	1151261,674	9643	2758	-
S18	739699,9651	1150751,668	127537	1	-
S19	737904,9685	1150351,669	156	34	-
S20	737638,974	1152041,665	19613	-	-
S21	736862,9741	1149981,665	72	6	-
S22	735577,9747	1149331,667	130	6	-
S23	734026,9726	1148291,669	1203	134	-
S24	732075,9811	1146991,663	714	61	-
S25	730147,979	1145431,671	130	5	-
S26	729105,9847	1143371,68	143	-	-
S27	728463,988	1142201,678	257	26	-
S28	727554,9908	1140438,677	120	5	-
S29	800948,8679	1171674,699	870	218	-
S30	802846,8633	1167668,694	694	171	-
S31	806133,863	1163544,704	331	2	-
S32	808639,8658	1159137,721	415	2	-
S33	811688,8657	1155233,726	643	175	-
S34	817891,868	1146209,742	-	2	-
S35	796971,8642	1173337,691	596	159	-
S36	793815,8745	1173125,684	499	88	-
S37	797135,874	1169279,697	451	54	-
S38	799032,8717	1165327,701	280	73	-
S39	802327,8699	1160281,708	112	5	-
S40	805288,8701	1155878,714	218	32	-
S41	807520,8717	1151468,732	616	242	-
S42	810844,8705	1147529,734	542	132	89
S43	813439,8707	1143400,744	446	147	126
S44	789368,8824	1169987,682	561	155	2
S45	792244,8845	1164623,694	1954	476	365

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
S46	794826,881	1161692,711	1361	388	263
S47	797516,8815	1156917,703	686	207	103
S48	800161,8845	1153064,717	511	157	120
S49	803702,8809	1149220,729	319	85	72
S50	806297,8811	1145090,74	394	72	68
S51	809354,8795	1140410,743	344	30	65
S52	783362,8898	1167685,691	50	5	4
S53	785185,8893	1168033,69	622	407	83
S54	787967,8887	1162926,7	550	278	80
S55	790371,8904	1159440,699	404	113	35
S56	793390,8919	1154446,706	585	106	112
S57	796566,886	1150450,719	259	46	84
S58	799345,8922	1146044,726	154	34	41
S59	802121,8887	1142008,737	1099	386	406
S60	804899,8889	1137787,747	180	65	7
S61	780182,8964	1165814,692	250	81	79
S62	780182,8964	1165814,692	2862	1634	79
S63	783142,8989	1161262,698	1223	304	189
S64	786321,8945	1156638,71	967	291	115
S65	789246,8934	1151956,703	526	1	-
S66	791931,897	1147642,721	296	76	71
S67	795166,8983	1143241,726	259	60	-
S68	797794,8984	1139295,74	261	127	133
S69	776597,9084	1162057,687	227	69	65
S70	779791,9032	1157784,696	765	157	148
S71	782474,9031	1153617,704	1362	329	282
S72	785341,9089	1149211,711	1327	302	318
S73	788299,9076	1145028,713	119	37	67
S74	791168,909	1140623,729	271	39	-
S75	794166,9083	1136127,734	604	311	293
S76	772747,9155	1159480,691	357	83	64
S77	775521,9164	1155074,698	865	135	143
S78	778203,9103	1150943,709	1353	248	296
S79	781253,9161	1146447,704	125	8	-
S80	783754,9137	1142223,714	160	59	63
S81	787079,9102	1137822,729	179	63	125
S82	789764,9138	1133599,739	403	141	96
S83	767282,9244	1157684,687	3672	1027	406
S84	770706,9206	1151899,694	198	35	70
S85	770706,9206	1151899,694	1051	109	70
S86	772836,9211	1148133,701	679	96	34
S87	776344,9259	1143456,703	917	207	68
S88	779026,9198	1139417,715	396	136	80
S89	782169,9223	1134829,729	152	40	19
S90	764123,9332	1152955,689	1077	245	104
S91	761999,9274	1156075,684	1639	283	69
S92	766527,9267	1149099,694	1056	290	166
S93	769853,9292	1144143,703	741	161	57
S94	772533,9276	1140197,716	26	57	21
S95	775582,9274	1135884,714	38	108	67
S96	778262,934	1132030,728	269	56	32

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
S97	778262,934	1132030,728	414	118	32
S98	756987,9384	1154654,673	3121	1040	271
S99	759668,9345	1150338,692	298	36	34
S100	762805,9422	1146118,701	596	171	40
S101	765396,9349	1141618,707	550	94	37
S102	768261,937	1137396,716	423	174	38
S103	770942,9414	1133265,717	368	51	18
S104	755669,9473	1147726,684	1063	386	35
S105	761032,9455	1138910,708	895	331	81
S106	763983,9435	1135242,705	583	122	56
S107	766391,9445	1130924,714	379	225	79
S108	769348,9455	1126610,732	46	11	23
S109	774173,9353	1129046,726	349	168	12
S110	781593,9335	1126890,735	224	-	-
S111	776586,9414	1124360,74	175	55	4
S112	772114,948	1123495,736	507	131	40
S113	749090,951	1148231,691	453	-	-
S114	751124,9534	1144741,691	211	66	6
S115	753711,9551	1140701,693	42	28	2
S116	756481,9569	1136570,704	445	157	8
S117	758978,9552	1132437,706	922	367	11
S118	758978,9552	1132437,706	131	20	11
S119	761844,955	1128030,713	45	-	-
S120	764431,9568	1124175,727	50	8	5
S121	767386,954	1120138,739	87	-	-
S122	744172,9645	1146352,673	1859	615	151
S123	746760,964	1141942,691	680	197	-
S124	749530,9657	1137719,7	471	170	13
S125	752302,963	1133403,709	321	175	12
S126	754890,9624	1129271,72	566	245	16
S127	758029,9657	1124866,717	112	19	5
S128	760804,9644	1120274,731	845	-	-
S129	737130,9723	1147779,673	1158	490	73
S130	739810,9706	1143093,687	474	164	9
S131	742394,9709	1139237,691	197	66	9
S132	744891,9692	1134919,7	520	273	30
S133	748209,9732	1130699,709	89	-	-
S134	751256,9694	1126293,716	57	21	7
S135	754393,9689	1122072,715	452	-	-
S136	757165,9744	1117849,725	136	68	6
S137	732401,9806	1144888,681	611	242	17
S138	734894,9797	1140754,673	9	3	2
S139	737663,9837	1136530,682	15	-	-
S140	740710,9798	1131754,695	61	22	2
S141	743571,9827	1127623,705	322	-	7
S142	746893,9777	1122942,718	124	-	-
S143	749846,9795	1118904,72	215	-	-
S144	752064,9797	1115414,731	84	-	-
S145	730985,9877	1138053,682	62	11	2
S146	726528,9934	1135165,69	52	-	-
S147	728927,0004	1131676,69	24	-	-

Sample ID	X	Y	Ilmenit (%)	Zircon (%)	Gold (g/t)
S148	732422,9992	1127825,694	218	55	14
S149	1107456,12	775059,09	6,86		
S150	1105117,15	776833,93	13,16		
S151	1103313,91	778157,16	1,11		
S152	1100830,52	780062,33	14,20		
S153	1098372,15	781890,59	4,00		
S154	1098756,7	780174,46	11,24		
S155	1103672,06	776500,81	8,31		
S156	1099935,85	777772,15	9,89		
S157	1104166,88	771548,85	10,52		
S158	1102146,81	773085,21	7,40		
S159	1100369,52	774445,52	1,37		
S160	1098145,59	776109,75	11,69		
S161	1095845,67	777857,4	11,70		
S162	1098708,99	773767,22	12,96		
S163	1102679,62	768924,61	13,26		
S164	1038303,65	828660,45	11,69		
S165	1036290,88	830258,01	12,97		
S166	1034905,44	831417,33	8,53		
S167	1032933,77	833004,19	7,01		
S168	1031131,49	834378,94	8,39		
S169	1031217	833037,08	1,94		
S170	1035295,18	829702,19	15,02		
S171	1029747,7	831172,31	1,38		
S172	1033181,26	828488,61	2,67		
S173	1035746,56	824844,57	6,21		
S174	1033996,89	826225,89	13,13		
S175	1032437,98	827482,22	12,17		
S176	1030602,8	828929,31	13,09		
S177	1028432,17	830731,6	2,00		
S178	1031129,02	827008,63	16,41		
S179	1028471,63	827692,71	3,18		
S180	1032477,45	822851,52	13,45		
S181	1099935,85	777772,15	9,87		
S182	1098708,99	773767,22	12,98		
S183	1030602,8	828929,31	13,06		
S184	1045282,565	822961,034	rare		
S185	1025134,487	839343,189	rare		
S186	1018181,847	844791,129	rare		
S187	1011580,389	850286,623	rare		
S188	998432,324	861175,17	rare	rare	
S189	991889,167	866613,993	rare		
S190	958734,829	887948,34	rare	rare	
S191	965902,771	882146,276	0,01	rare	
S192	972328,039	876261,372	0,01	rare	
S193	986928,813	864746,95	rare		
S194	999468,862	854264,171	rare		
S195	1013048,169	842983,767	rare		
S196	1026874,053	832053,684	2,18	rare	
S197	1025134,487	839343,189	5,45	rare	
S198	972328,039	876261,372	rare	rare	