Clay Deposits in the Sile region, Türkiye

17th International Clay Conference
July 30, 2022, Istanbul, Türkiye
Orhan Yavuz, Paul A. Schroeder, Emin Ciftci, and Huseyin Demir
Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Geologic background and industrial uses of Sile clays</td>
<td>4</td>
</tr>
<tr>
<td>Chemistry and mineralogy of the clays and surrounding rocks</td>
<td>8</td>
</tr>
<tr>
<td>Field observations and data</td>
<td>11</td>
</tr>
<tr>
<td>Evaluation of clay for porcelain, tile, sanitary, and tableware production</td>
<td>17</td>
</tr>
<tr>
<td>History of the Sile District</td>
<td>18</td>
</tr>
<tr>
<td>References</td>
<td>19</td>
</tr>
<tr>
<td>Road Log</td>
<td>22</td>
</tr>
</tbody>
</table>

Acknowledgements: Thanks are given to Cafer ÇABUĞ and Tuncay ULUSOY of GÖZDE EREN and EREL Mining companies for providing access to the mines and allowing for sampling. We also thank Gözde Eren Mining Engineer Adnan Geredeli for technical data about Şile clays. The U.S. National Science Foundation provided support for student and early career scientists to participate (EAR-2224821). Istanbul Technical University assisted with ground support logistics.
Clay Deposits in the Sile region, Türkiye: Mineralogy, Chemistry, Geologic history, and raw material for ceramics industry

Orhan Yavuz¹, Paul A. Schroeder², Emin Ciftci¹,², Huseyin Demir²,³

Istanbul Technical University¹, Geological Engineering, Faculty of Mines, 34469 Maslak, Istanbul, Türkiye

University of Georgia², Department of Geology, Athens, GA 30602-2501 U.S.A.

General Directorate of State Hydraulic Works³, Technical Research and Quality Control Department, Concrete Laboratory, Pursaklar, Ankara, Türkiye

This field guide was produced in association with the AIPEA 17th International Clay Conference and the annual meetings of the Clay Mineral Society and Clay Science Society of Türkiye, July 30, 2022, Istanbul, Türkiye.

Introduction

The Sile kaolinite-rich clay deposits are known as one of Türkiye’s largest clay resources and are economically important (Ece et al., 2003). Worldwide, kaolinite has comprehensive industrial applications, including use in ceramics, paints, paper, pharmaceutical products, cement, membrane, geopolymer, wastewater treatment, catalysis, pesticides, detergents, cosmetics (Murray and Keller, 1993; Zunino et al., 2020; Zhang et al., 2020; Fellah et al., 2020; Olu-Owolabi et al., 2021; Gianni et al., 2020; Mubarak et al., 2021; Rashad et al., 2021; Awwad et al., 2020; Cao et al., 2021; Cai et al., 2021). As well as the many industrial applications, these kaolinite-rich deposits also contain mineral markers that record paleoenvironmental factors that can be used for interpreting the geologic history of a region. Kaolinite-bearing units also can carry significant indicators in terms of the weathering processes of parent materials and soil development mechanisms in time and space for both Earth and other planets (Fackrell et al., 2020). The goal of this field trip is to examine the vertical mineral and chemical variations within a well-exposed kaolin mining site, with the intent of understanding what factors influence the suitability of the material for industrial applications. We also visit surrounding sites that show outcrops of the basement rocks that both host the deposits and may have served as sources for sediments that comprise the clay deposits.
We suggest that mineral and chemical composition at any one layer in the deposit is controlled by three geologic factors that include: 1) the sediment provenance and environmental conditions at the time of deposition, 2) diagenetic alteration after deposition, and 3) meteoric weathering upon exposure related to tectonic uplift. The latter most factor is now more holistically considered in the study of Critical Zone (CZ) science, where the physical, chemical, and biological alteration of regolith includes treetops to bedrock (Richter et al., 2020). We posit that in addition to the first two factors being key to ore quality and application, recent CZ processes also may be important modifiers to mineral and chemical properties of the deposits.

Geologic background of Sile clays

Surrounding rocks in the Sile region are Istanbul Paleozoic meta-sedimentary units, Permo-Triassic sedimentary rocks, Late Cretaceous volcanic/volcano-sedimentary rocks and flysch series (Figure 1). Collectively, the rocks comprise the Istanbul zone, which is interpreted as a rifted fragment from the Odessa shelf that was translated to the south with the opening of the western Black Sea basin (Okay et al., 1994). The İstanbul Paleozoic sequence is represented by different regressive and transgressive basin units, which were intensely faulted. The sequence starts with Early Ordovician clastics that comprises marine turbidites, deltaic deposits and passes upwards into terrestrial fluvial units composed of purple arkosic conglomerate, sandstone, siltstone and shale intercalations. These are overlain by Early Ordovician shore-shallow-sea quartz sandstones, and lagoonal-shelf facies Middle Ordovician to early Silurian conglomerates and shale and sandstone-shale. These formations are overlain by late Silurian to early Devonian limestone, nodular limestone (shelf-deep shelf transition), and then limestone interlayered with micaceous shale and sandstone that are early to middle Devonian in age, deposited in a deep shelf facies. These were followed by middle to Late Devonian-early Carboniferous cherty limestone (deep shelf slope) and Early to Middle Carboniferous turbiditic sandstone and shale alternation in the uppermost of the Paleozoic succession (Gedik et al., 2005). Different formation names have been used in different review studies for these Paleozoic units. Recently, Ozgul (2012) distinguished members of the Istanbul Paleozoic in more detail. The Istanbul Paleozoic sedimentary sequence is also summarized by Lom et al., (2016).
The Permian-early Triassic (Permo-Triassic, early to middle Triassic?) terrestrial succession unconformably covers the Paleozoic units in the study area. These successions are divided into three partly different units (Gedik, 2005). These start at the bottom with red-colored fluvial deposits and pass into shallow water sandstone and carbonate. Sandy and clayey limestone and dolomitic limestone and dolomites characterizing shallow shelves overlie these units (Yurtsever, 1982). These series were found only around thrust zones within the study area but more common further to the east. Late Triassic and Jurassic rocks were absent in the study area.

A volcanic and volcano-sedimentary sequence is found in the northern part of the study area related to arc magmatism resulting from the north-dipping subduction of the Neo-Tethys Ocean along the İzmir-Ankara-Erzincan suture (Şengör and Yılmaz, 1981). Using isotopic data from the Central Pontides, Okay et al. (2006) concluded that the Neo-Tethys was already subducting under the Pontides in the Early Cretaceous (~105 Ma.), with the magmatic arc beginning to develop in the Late Cretaceous. U-Pb zircon ages obtained from calc-alkaline andesitic to dacitic dikes within the Istanbul Paleozoic unit in the south yield ages ranging from 72.49 ± 0.79 to 65.44 ± 0.93 Ma (Aysal et al., 2015). The volcanism ceased by the end of the
Late Cretaceous (Şengör and Kindap, 2019) and these volcanic and volcano-sedimentary rocks are overlain by Late Cretaceous-Paleocene pelagic limestone and marl (Ketin and Gümüş 1963).

During the Eocene, multiple collisions of small continental fragments resulted in compressional movements, giving rise to pre-Lutetian folding and faulting in the study area (Şengör and Yılmaz, 1981; Gedik et al. (2005). During this event Paleozoic and Mesozoic units were thrusted over the Upper Cretaceous- Lower Eocene sequence (Ozgul, 2012) and is now known as the east-west striking Şile Thrust. The Sile Thrust is a back thrust associated with the closing of the northern branch of the Neo-Tethys Ocean, known as the Intra-Pontide Ocean.
The Lutetian shelf and shallow marine succession composed of interbedded shale-limestone and sandstone was deposited in the Sile region. Because of the movement of the Sile thrust, the study area experienced rapid, post collisional uplift and there was no deposition in the region until the Pliocene (Lom et al., 2016). However, Gedik et al. (2005) suggested that deposition started in the Oligo-Miocene based on the palynological from the coal layer within the terrestrial clastic sediments. In places near the eastern and western Istanbul Bosphorus area (Sarıyer and Anadolucağı) the Sile thrust fault occurs as high angle faults that include components of oblique transform and/or reverse faults, as opposed to true thrust fault architecture.

Figure 3. Geology of the Sile Region. based on the MTA, 2005- 1/50000 scale geological maps of Türkiye. Red sample locations show generalized areas of collection. More detailed site locations were sampled and can be found in Demir (2021).
All tectonic events leading up to the Miocene are herein collectively considered as the Paleotectonic period. The new tectonic era (i.e., herein the Neotectonic) characterized the region since at least the late Miocene. The elimination of the last portion of ocean between Arabian and the Anatolian plates developed the North Anatolian Shear System, and gave rise to the North Anatolian Fault, which initiated its dextral strike-slip motion around late-medial Miocene (Ketin, 1966; Şengör et al. 1985; Yılmaz, 1993; Le Pichon et al., 2001; Okay, 2008). Although the fault was initiated across the full region in the Pliocene (Bozkurt, 2001), the shear system has been extant since late Miocene (Şengör and Kindap, 2019). This new phase reveals itself by extensional features in the area.

Chemistry and mineralogy of the clays and surrounding rocks

To highlight the chemistry and mineralogy of the region samples were collected in the Sile region northeast of Istanbul. This included regional outcrops and a mine operated by Erel Maden (41° 8.619’N, 29° 27.808E) (Figure 3). The benched nature of the mine allowed for quasi-vertical sampling with heights above the lowest excavation level recorded. Twenty-five samples were collected with general field descriptions given to each and measures of the sample section thickness (Figure 4). The top three samples occurred in a sand-rich facies crosscut by a mud-filled dike (Figure 5) interpreted to be a result of brittle fracturing and liquefaction mud emplacement during a tectonic event.

X-ray powder diffraction (XRD) was used to characterize both bulk and clay fraction (<2 µm) in mineral assemblages of the collected samples. Approximately 10 g of each sample was dried at 65°C overnight. Approximately 5 g of dried sample was hand-ground with a corundum mortar. The powder was then further ground in a McCrone micronizing mill for 10 minutes with 10 ml ethyl alcohol to reduce the particle size to an average of 5 to 10 µm. Ten percent by weight ZnO was added as an internal standard (IS). Samples were dried to remove alcohol in an oven at 65°C overnight and then backfilled against a plate glass into a 2.5 x 2.5 cm aluminum holder. The powder was pressed at 400 psi to make a flat self-supporting mount. This minimized sample transparency in the X-ray beam. A Bruker D8 Advance X-ray Diffractometer was configured using a 250 cm goniometer radius, a 0.6mm divergent slit, and Bragg-Bentano geometry. A knife-edge blade was placed 2mm over the samples surface to minimize low angle scatter into the Lynx-Eye® position sensitive detector. A cobalt radiation source operated at 35 kV and 40 mA, was used (Kα₁ = 1.7890Å and Kα₂ = 1.7928Å) with an iron filter to minimize Kβ radiation. An external NIST Reference standard SRM1976b corundum (α-Al₂O₃) was run to confirm alignment and calibration within 0.05 ° 2Θ tolerance
of the certificate value for the strongest reflection peak position. Scan range extended from 2 to 80° 2θ, using locked-coupled continuous scan mode with a step size of 0.01° 2θ and count rate of 0.1 seconds per step. Raw data and plots are presented with patterns and peak positions determined by Bruker Eva® software. Raw data was Kα2 stripped. The IS was used to correct for sample displacement error, which was usually less than 0.05° 2θ. Peak positions were matched with data from the International Centre for Diffraction Data (ICDD) powder diffraction file (PDF) database. Eva software was used with the 2019-PDF database to find best-fit phases for mineral identification. Structure files for each phase identified were exported, which contained unit cell lattice parameters, atom types, and atomic coordinates. Many of the sample mineral assemblages included mixed-layer clay minerals. The ICDD-PDF does not contain structure files for mixed-layer clays, therefore only discrete minerals could be assigned to bulk XRD patterns.

Bruker TOPAS® software was used for semi-quantitative models of samples. This program is based on the Rietveld refinement method (Rietveld, 1967). In brief, this method calculates the theoretical diffraction pattern for each phase using kinematic diffraction theory (Schroeder, 2018). It then uses optimization schemes to minimize the difference between observed XRD data and calculated patterns. Included in the TOPAS software are options to optimize structure file data and other parameters such as preferred orientation crystal planes and mean coherent scattering domain size. The routine also optimizes total XRD intensity, which is related to abundance. In all cases, ZnO IS abundance was allowed to be optimize as a check for agreement between model results and the known weight fraction addition of IS. In most cases, the agreement was within +/- 10% of the known amount added. Each refinement’s goodness-of-fit was evaluated using the weighted profile R-factor (Rwp), which is fully explained by Tobi (2006). Generally, model solutions with Rwp <15 are considered acceptable for semi-quantitative analysis. It is important to note that the TOPAS software does not allow for mixed-layer structures to be included in the calculations, therefore regardless of other optimization efforts, in some cases, satisfactory Rwp values were not achieved. Despite this limitation, consistent practices were used to keep model parameters with similar ranges of values to allow inter-sample comparison of relative abundances.

For the fine fraction (<2 µm), approximately 10 g of each sample were taken and dried in an oven at 65°C overnight. Dried sample was placed in a centrifuge tube with a solution of 38 g Na-hexametaphosphate and 8 g of Na-carbonate per liter of deionized water and dispersed using a Branson Sonifier Cell Disruptor 350 for around 1 minute. The sample was then sieved to remove the sand fraction (>63 micron) with a 230 mesh. The <2 micron clay fraction was
separated from <63 micron fraction by using standard centrifugation techniques (Schroeder, 2018). The resultant slurry was considered Na-saturated after this treatment. This step was repeated for Mg-saturation by exchanging 0.1 M MgCl₂ solutions. Deionized water was added to the slurry and repeated centrifugation was applied again to remove excess salt (Austin et al., 2020). This fine fraction was then dispersed in 25 to 30 ml of deionized water and drop-cast by pipette onto a glass petrographic slide (25 mm x 40 mm) and dried overnight. This drying process creates oriented particles that enhance the basal reflections of phyllosilicates / clay minerals. Select duplicate slides were prepared on selected fresh samples for formamide intercalation testing to distinguish the presence of halloysite in kaolin bearing samples (Churchman 1990). For the formamide tested, samples were exposed to formamide for around 30 minutes and then scanned.

The oriented slide(s) was scanned from 2 to 40° 2Θ, using locked-coupled continuous scan mode with a step size of 0.01° 2Θ and count rate of 0.1 seconds per step. Data were collected for each sample in states of air-dried (AD) overnight at ambient relative humidity, ethylene glycol (EG) overnight at 65° C in closed ethylene glycol atmosphere and heated in the oven overnight at 110°C, 350°C, 550°C. Based on locations of the peak and their movement, changes in intensity, or disappearance depending upon stage of treatment the types of clay minerals were identified. In this case of the oriented clay fractions, NEWMOD2 software was used to understand the nature of mixed layer clay minerals for the EG-Mg saturated state.

Inductively Coupled Plasma (ICP) Optical Emission Spectroscopy (OES), Mass Spectrometry (MS) and Loss-on-ignition (LOI) analyses were used to characterize the elemental compositions. Approximately 5 g of each sample were analyzed by Activation Laboratories (Actlabs) in Ontario, Canada for their 4-LITHO (with their RX4 sample preparation) geochemical characterization of major oxides and trace elements. This method uses high temperature (molten) lithium metaborate/tetraborate fusion performed by automation at Actlabs and the resultant was immediately digested in a weak nitric acid solution. Analysis was performed by ICP-OES and ICP-MS (for detection limits, see https://cdn.actlabs.com). LOI was independently measured by heating a known sample mass to 950°C in an open atmosphere to volatilize carbonate, sulfates, hydroxide-bearing, and organic matter components. Mass loss is measured after the heating treatment. Mass gain is possible if reduced iron is present which reacts to form iron oxide.
Field observations and data

A stratigraphic section of the quarry shows that these deposits consist of clay-rich, sand-rich, and gravel-rich interbeds of varied thicknesses (Figure 4). Gray, yellowish gray, greenish-gray, white, cream, pinkish and reddish-brown, brown, blackish colors were identified with the different colors of layers within the section. Each color was mainly defined by the amount of organic material and iron-rich minerals. Sand- and gravel-rich lenses and thick-cyclic coal seams were also observed sporadically. In the uppermost part of the section, there were vertical reddish brown clay dikes within the cream sand layer (Figure 5). These deposits appear to be associated with fluvial-lacustrine environments, as evidenced by channel lag gravels, coal seams, and the textures in the sand layers.

Quartz and phyllosilicates were clearly seen in XRD whole-rock patterns (Figure 6). Minor phases included anatase, gibbsite, and goethite. Hematite, siderite, and pyrite were not found at every level, but occurred in minor proportions exclusively at separate level.

Semi-quantitative proportions of these minerals in each sample, based on Rietveld analysis, are shown in Figure 9. Only discreet, reasonably well-ordered minerals could be modeled to achieve fits with $R_{wp} < 15$. Results show that quartz, illite, and kaolinite were the most abundant minerals ranging between 15 to 50%, 10 to 25%, and 20 to 60%, respectively. From the base of the stratigraphic section, patterns of quartz abundance trend by decreasing from 50% to about 10% at 6.35 m, then an increase to about 50% at 14.35 m, then a decrease to about 25% at 21.9 m, and finally an increase to about 40% at 30 m at the top. The sand-rich cap was about 8 m thick. Kaolinite and illite abundance varied antithetical to the quartz trends. Assuming the quartz is coarser in grain size than the clay minerals, then this mineral pattern reflects two cycles of fining-upward sequences followed by coarsening upward sequences. Each cycle also has three coal seams within the sequence. Although likely not full cyclothems (sensus sticto, per Wanless and Weller, (1932); i.e., sediments lain by marine-nonmarine conditions driven by eustatic sea-level changes), these repeated cycles may reflect oscillations in climate and rates of tectonic uplift.
Figure 4. Mine photograph and related stratigraphic sections of a Sile Mine. Thicknesses for differently textured layers are indicated on the side of the column. Also indicated are the sample locations and numbers on the opposite side of the column (Dotted and black lines represent sand and clay rich layers, respectively. Black layers represent coal seam). Photo date 2017.
Figure 5. Clay dike situated in sandy fluvial layers overlying the clay formation. The clay mineralogy of the dike is similar to the underlying clays. Iron oxides (orange = goethite and red = hematite) accentuate cross bedding and Liesigang bands that emanate outward from the vertically crosscutting dike, suggesting that past ground waters fluctuated in redox states with iron mobilization facilitated by microbial reactions. Emplacement may be related to extensional tectonics and liquefaction related to earthquakes originating from movements of the North Anatolian fault.
Figure 6. Bulk X-ray diffraction patterns from select samples in the Sile Mine. See Figure 4 for corresponding sample numbers and locations. Labeled peaks show major minerals including illite (~9.9Å), kaolinite (~7.2Å), quartz (~4.25Å and 3.33Å), siderite (~3.58Å and ~2.79Å), goethite (~4.16Å).

Figure 7. Oriented fine (<2 µm) fraction (Ca- and ethylene glycol-saturated) X-ray diffraction patterns from select samples in the Sile Mine. See Figure 4 for corresponding sample numbers and locations.
Figure 8. Oriented Ca-saturated fine fraction X-ray diffraction patterns S17-20 in air-dried, ethylene glycol-saturated, and heated 110° 350°, and 550°C in the Sile Mine. See Figure 4 for corresponding sample numbers and locations.
Evaluation of clay for porcelain, tile, sanitary, and tableware production.

The Sile clay region began major mining in 1980, at which time refractory clays were exploited for the ceramic sector. Mining companies producing clays include Gözde Eren & Erel, Matel, Toprak Seramik, Bilek Madencilik, Etıler Madencilik, Daşdan Madencilik, Esan, Eryılmazlar, Er Madencilik, Ergören, Ertepe, Alyans, Sörhaz, Söğüter, and Mitaş. In recent years the total clay production was approximately 2.5 million tons (MT) per year (Genç, 2019). Annual clay production for 2021 reached 3.7 MT. The majority of the production (~85%) is used for the domestic market, where for example the Sile region supplies 90% of the clay for ceramic square tiles. The Sile clays are also used as ball clay, fire clay and in limited cases high-iron refractory clay, where in addition to the square floor tile market other products include porcelain and vitrified ceramics for the health and technical industries. Clay producing companies consider loss-on-ignition (LOI), Al₂O₃, Fe₂O₃, SiO₂, and organic matter content for quality evaluation. Also factored are shrinkage, water adsorption, color and strength properties.
The quartz-rich sand that often caps the clay deposits are also mined and used for filling, casting, filter materials, and in the building industry throughout the area, including Istanbul, Thrace, and Marmara regions. The sands are variable in size and composition, with the whiter, homogeneous, quartz-rich sands having high value. The total quartz sand export from the region over the past 20 years is approximately 20 MT. Total sand production in 2018 was 4.5 MT (Genç, 2019).

The suitability of Sile clay for porcelain tile production is not only dependent on the composition of the raw ore from the mines, but also the fluxes and the degree of premilling (Yavuz et al. 2011; Aras, 2018). Yavuz et al. (2011) note that various combinations of clay and fluxes lead to optimal plasticity and green strengths, as well as color of the fired product. A formulation of 1:1 plastic kaolinite-rich clays and non-plastic albite, K-feldspar, and quartz makes a good starting point (depending on the application). Sintering at fast firing rates (1200°C in 50 min) creates a product bearing residual quartz, feldspar, newly formed mullite, and a glasses matrix. The main underclays in the Sile region and in the Agacli-Kemerburgaz (to the west of the Bosphorus) provide an abundant and valuable resource for making porcelain, tile, sanitary, and tableware products. Yavuz et al. (2011) examined the firing properties of Sile clay (1212°C in 34 min) and observed a 6.45% shrinkage, 3.5% water absorption, 4.10 (N/mm²) breaking strength, and chromatic values of $L^*a^*b^*$ of 69.28, 7.06, and 24.24, respectively. This same material had a chemical composition of SiO$_2$ (60.8%); Al$_2$O$_3$ (23.8%); Fe$_2$O$_3$ (2.5%); TiO$_2$ (1.2%); CaO (0.1%); MgO (0.4%); Na$_2$O (0.0%); K$_2$O (2.3%); and LOI (8.9%). Yavuz et al., (2011) further noted that water absorption and flexural strength are the most important properties for ceramic products used in civil construction. Water absorption is related to porosity that is lost upon sintering above 900°C. From 900°C to 1200°C the flexural strength increases significantly from about 30 Kg/cm² to 150kg/cm². The $L^*$ (lightness values) also tend to drop depending on the peak firing temperature ($L^*$ is calculated using the cube root of relative luminance offset to near black or more simply, $L^*=0$ : black and $L^*=100$ : white).

It has been noted since Roman times that adding 10% fine calcite improved the physical properties of ceramics for a wide range of uses (Schmidt-Reinholz and Schmidt, 1997). Aras (2018) performed interesting experiments using Sile clay to explore the roles of alkaline- and alkaline-earth-flux effects on the phases formed in ceramics. Additions of K- and Na-fluxes result in eutectic melts, whereas Ca- and Mg-fluxed forms result by solid state reactions (Aras 2002). With lower alkaline-earth content there is a tendency to formation of glass phases, but the presence of Mg inhibits melt formation and changes the phase assemblages toward feldspar formation. Celik (2010) investigated a clay sample from the Sile region for its application in
the ceramic industry. The figures below from Celik (2010) show the results of technical characterization, in which the Sile Clay (IC) was compared to more illite-rich clay from Afyon Province in central Anatolia, Türkiye (AC).

![Figures showing technical characterization results.](image)

**History of the Sile District:** [Source](http://www.allaboutistanbul.com/sile.html)

Sile is a pretty resort town on the Black Sea coast of Istanbul, on the Asian side, about 65 kilometers (40 miles) northeast from the city center. It can be reached via side roads passing from Polonezköy or directly from the TEM Highway. The name of Sile comes from Greek, which means a kind of flower (Mercankösk in Turkish). Sile has long sandy beaches and it gets very popular especially during the summer time. Its population is around 35,000 but it triples during the holiday season, even up to 10 times during the summer weekends. During the spring and on nice autumn weekends, people from Istanbul come to Sile to taste the fish in one of the restaurants around the fishermens' harbor or to stroll in its narrow streets. The town has the biggest lighthouse of Türkiye which is a small restaurant today overlooking the Black Sea, it
also became the symbol of Sile. Just above the harbor, there are ruins of a Genoese fortress on the steep rocks which was also used during the Ottoman period.

Sile town is famous for its special cotton fabric, called Sile Bezi. Turkish women love this textile because it's very light, thus nice to wear during hot summer days. Many shops in the market sell clothing, tablecloths and other stuff made with Sile Bezi. There is a local Sile Bezi Festival every year between July-August. Sile has many small hotels and pensions where people can stay for the weekend having a short sea holiday. When it's windy, the Black Sea can be rough and sometimes dangerous to swim because of high waves and strong undercurrents. Many people from Istanbul have their summer houses too. İskı University has a campus in Sile, just before entering the town. It's one of the newest private universities of Türkiye.

References


Genç, Ş. C., 2019. Şile Bölgesi kil ve kumlarının başta seramik sektörü olmak Üzere ilgili diğer sektörler için ekonomik öneminin ortaya konulması. İstanbul Technical Universit, technical report prepared on behalf of the Seramik Araştırma Merkezi.


https://cdn.actlabs.com

http://www.allaboutistanbul.com/sile.html