

Field Trip 2  
(July 30–31, 2022)

## BENTONITE AND KAOLIN OCCURRENCES IN BALIKESİR

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Balıkesir (280 km south of İstanbul) is a province where there are many types of mineral and industrial raw materials, as well as natural stone reserves. The bentonite and kaolin formations in the province of Balıkesir are in the **Çağış** area for bentonite and **Düvertepe** area for kaolin.



## ÇAĞIŞ BENTONITE DEPOSIT

*One of the largest Bentonite area of Turkey*

The widespread Balıkesir bentonite deposits in western Anatolia have economic potential. They are important raw materials for the paper and bleaching industries in Turkey. These numerous bentonite deposits are associated with Miocene volcanic-sedimentary rocks. The Çağış area has the most important Na- and Ca-bentonite deposits in Balıkesir district.



Basement rocks of the Balıkesir region are comprised of Paleozoic – Mesozoic metamorphic rocks, Upper Cretaceous (Maastrichtian) flysch series, and Upper Cretaceous ophiolitic mélange.

Acidic to intermediate volcanism became very active during Miocene in the Balıkesir region. Miocene volcano - sedimentary succession unconformably overlies the basement rocks.

The volcanic rocks are composed of rhyolite rhyodacite, dacite, andesite, and their pyroclastics. Geological, mineralogical and geochemical features of the bentonite deposits suggest *in-situ* alteration of these pyroclastics.



The bentonite deposits in Balıkesir region are composed of abundant montmorillonite associated with feldspar, calcite, dolomite, quartz, opal-CT, minor to accessory illite, chlorite, and kaolinite.



## DÜVERTEPE KAOLIN DEPOSIT

*The largest Kaolin area of Turkey*

The Düvertepe district (Balıkesir, western Anatolia, Turkey) located on the western end of the Simav Graben is the largest known fossil hydrothermal kaolin deposit in Turkey. There are many high sulfidation epithermal kaolin deposits in the Düvertepe district, with each situated in silicified zones as a consequence of hydrothermal alteration associated with fracture systems.



Kaolinization was formed as the result of acid sulfate geothermal waters by controlling N–S extension tectonic regime. Hydrothermal fluids at temperatures of 38-129 °C, which followed the fracture systems in the region. Thus kaolinization is common along fault zones and silica sinters are located above the kaolin zones as a mark outflow of geothermal waters.



The basement group consists of Paleozoic metamorphic rocks and Mesozoic complexes. Early–Middle Miocene volcanics include rhyolite-rhyodacite lavas, perlite, tuff and pumucite, with the largest kaolin reserves hosted within Early Miocene rhyolite-rhyodacite tuffs.



Kaolin formations have white, gray, greenish gray, pink and reddish pink colors. Two mineral facies were described in the region; (1) kaolinite–alunite–quartz and (2) alunite–opal-CT–quartz–halloysite. The total kaolin reserve in the region is approximately 20 million tones with current annual production of 400,000 tones/year.

The trip will depart by bus from the meeting venue with a one-way travel time of approximately 4 hours to reach the Balıkesir region. Accommodations for an overnight stay and meals will be included as part of the field trip registration.

### **Articles on bentonite and kaolin deposits in Balıkesir and surrounding region**

Çoban, F. (2014). The mineralogy and geochemistry of Bigadiç (Balıkesir) bentonite deposits and the mobility of major, trace and rare earth elements during bentonitization. *Çukurova University Journal of the Faculty of Engineering and Architecture*, 29(2), 55–68.

Ece, Ö.I., Schroeder, P.A. (2007). Clay mineralogy and chemistry of halloysite and alunite deposits in the Turplu area, Balıkesir, Turkey. *Clays and Clay Minerals*, 55, 18–35.

Ece, Ö.I., Schroeder, P.A., Smilley, M.J., Wampler, J.M. (2008). Acid-sulfate hydrothermal alteration of andesitic tuffs and genesis of halloysite and alunite deposits in the Biga Peninsula, Turkey. *Clay Minerals*, 43, 281–315.

Ece, Ö.I., Ekinci, B., Schroeder, P.A., Crowe, D., Esenli, F. (2013). Origin of the Düvertepe kaolin-alunite deposits in Simav Graben, Turkey: Timing and Styles of hydrothermal mineralization. *Journal of Volcanology and Geothermal Research*, 255, 57-18.

Kadir, S., Külah, T., Erkoyun, H., Christidis, G.E., Arslanyan, R. (2019). Geology, mineralogy, geochemistry, and genesis of bentonite deposits in Miocene volcano-sedimentary units of the Balıkesir region, western Anatolia, Turkey. *Clays and Clay Minerals*, 67, 371–398.

Mutlu, H., Sarıöz, K., Kadir, S. (2005). Geochemistry and origin of the Şaphane alunite deposit, western Anatolia, Turkey. *Ore Geology Reviews*, 26, 39–50.

Oygür, V. (1997). Anatomy of an epithermal mineralization: Mumcu (Balıkesir–Sındırgı), inner-western Anatolia, Turkey. *Mineral Research and Exploration Bulletin*, 119, 29–39.

Sayın, S.A. (1984). The role of hydrogen-metasomatism in the hydrothermal kaolin occurrences, Gönen, western Turkey. *Key Engineering Materials*, 264–268, 1379–1382.

Sayın, S.A. (2007). Origin of kaolin deposits: evidence from the Hisarcık (Emet–Kütahya) deposits, western Turkey. *Turkish Journal of Earth Sciences*, 16, 77–96.