

प्रकरण:४. खडक

10/9/2017

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as study material.

- **खडक:**
- Naturally occurring solid aggregate of one or more minerals or mineraloids.
- पृथ्वीच्या भूकवचातील कोणता ही घनरूपी पदार्थ /घटक म्हणजे खडक होय.
- पृथ्वीचे कवच जवळजवळ पूर्णपणे घन पदार्थांचे बनलेले आहे.
- कवचाच्या घन घटकास खडक असे म्हणतात. अनेक प्रकारच्या खडकांचे बनलेले आहे.
- सामान्यतः बहुतेक सर्व खडक कठीण, घट्ट व एकसंध असतात.
- खडक या शब्दाची भूवैज्ञानिक व्याख्या अधिक व्यापक आहे.माती, वाळू, गोटे यांच्यासारखे सुटे पदार्थही भूवैज्ञानिक दृष्टीने खडकच आहेत.

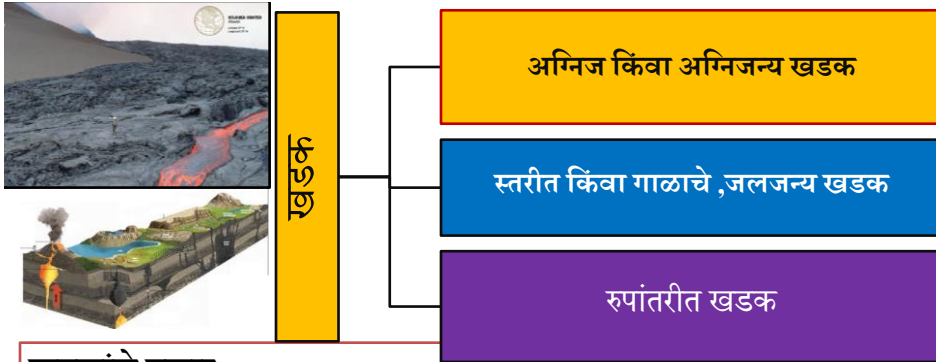
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- खडकांचे दुसरे वैशिष्ट्य म्हणजे ते सामान्यतः काही विशिष्ट रासायनिक संघटन व त्यानुसार प्राप्त झालेला आकार असलेल्या खनिजांचे असतात.
- बहुतेक खडक दोन अथवा अधिक खनिजांचे बनलेले असतात.
- थोडे खडकच पूर्णपणे एकाच खनिजाचे बनलेले असतात; उदा., ⇨ क्वार्ट्झाइट, ⇨संगमरवर.
- खनिजांचे बनलेले नसूनदेखील खडक असणारे काही थोडे अपवाद आहेत; उदा., ज्वालाकाच (ऑब्सिडियन) ही खनिज नसलेली ज्वालामुखी काच असून ती खडक आहे.
- दगडी कोळसा कार्बनी पदार्थाचा बनलेला असतो व तो पण खडकच आहे.
- ठिसूळ, सुटी ज्वालामुखी राख देखील खडकाचाच प्रकार आहे.

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खडकांचे प्रकार:

खडक निरनिराळ्या क्रियांनी तयार होतात.

- (१) **अग्निज/अग्निजन्य खडक:** शिलारसाचे घनीभवन होऊन तयार झालेले अग्निज खडक (उदा., बेसाल्ट),
- (२) **स्तरीत/गाळाचे खडक:** गाळाचे निक्षेपण होऊन (साचून) तयार झालेले गाळाचे खडक (उदा., वालुकाश्म)
- (३) **रूपांतरित खडक:** कुठल्याही प्रकारच्या मूळ खडकांचे रूपांतरण होऊन तयार झालेले रूपांतरित खडक (उदा., संगमरवर)

10/9/2017

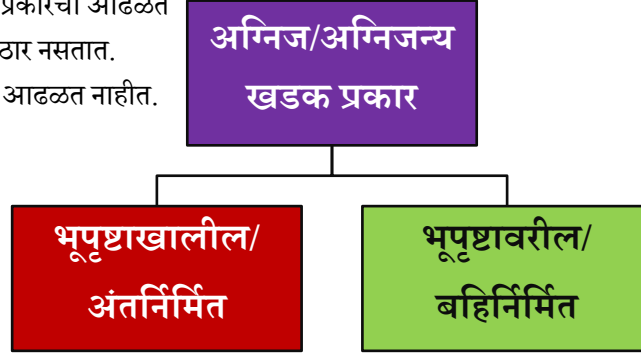
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अग्निज/ अग्निजन्य खडक प्रकार:

- ज्वालामुखीच्या उद्रेकातून तप्त द्रवरूप लाव्हा (शिलारस) बाहेर पडतो व भूपृष्ठावर तसेच भूपृष्ठाखाली थंड होतो. त्यापासून निर्माण होणाऱ्या खडकास अग्निज खडक म्हणतात.

वैशिष्ट्ये:

- कठीण व कणीदार असतात
- भिन्न आकाराचे व रंगाचे असतात
- रचना वेगवेगळ्या प्रकारची आढळते
- एक संघता असते ठार नसतात.
- खडकात जीवाश्म आढळत नाहीत.

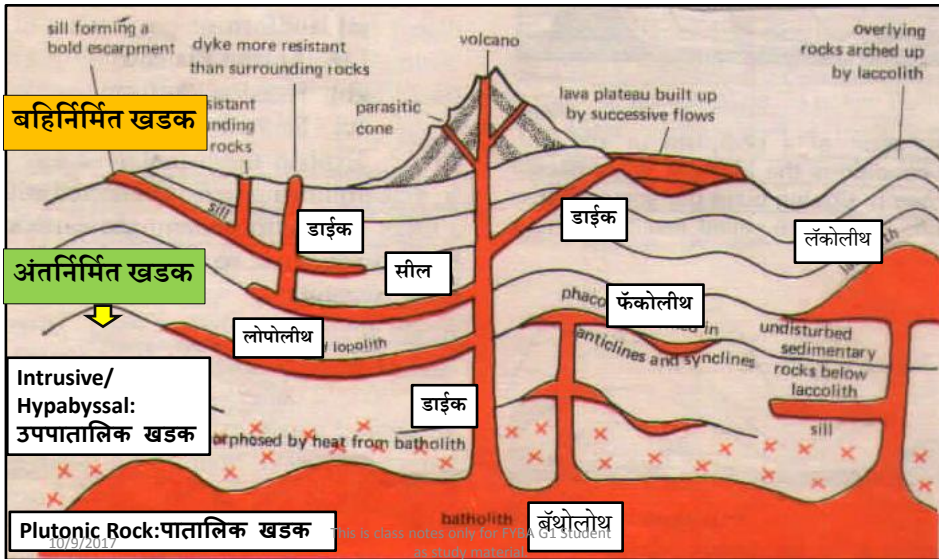


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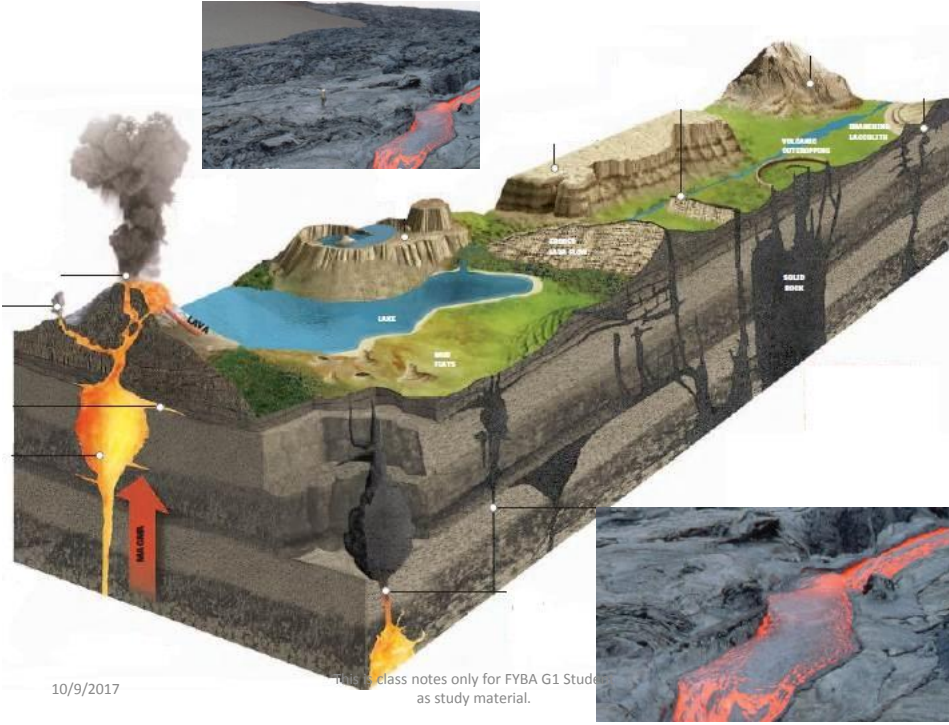
अंतर्निर्मित अग्निजन्य खडक:

- डाईक
- सील-शीट
- लॉकोलीथ
- लोपोलीथ
- फॅकोलीथ
- बॅथोलोथ



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बहिर्निर्मित अग्निजन्य खडक: (Extrusive Igneous Rock)-

“भूपृष्ठाला पडलेल्या भेगातून व ज्वालामुखीच्या उद्रेकातून लाव्हा रसाच्या रूपाने तप्त शिलारस भूपृष्ठावर येऊन थंड होऊन ज्या खडकांची निर्मिती होते त्यांना बहिर्निर्मित अग्निजन्य खडक किंवा ज्वालामुखी खडक असे म्हणतात”

- रंगाने काळे, लहान स्पटिक,
- कारण लाव्हारस भूपृष्ठावर जलद थंड होतो,
- उदा. बेसाल्ट ,
- फेल्डस्पार व ऑर्गाइट खानेजे ,

दोन प्रकार:

१. स्फोटक प्रकार :

- ज्वालामुखीतून लाव्हारस बाहेर फेकला जातो, व लाव्हारसाच्या निक्षेपानातून खडक तयार होतात. त्यांना स्फोटक प्रकारातून निर्मित ज्वालामुखी खडक म्हणतात .
- उदा. बेसाल्ट /असिताशम , दख्खनचे पठार , महारष्ट्र पठार

२. शांत प्रकार:

- ज्वालामुखीतून लाव्हा रस सावकाश बाहेर येऊन पसरतो व शांत हून खडक बनतात व
- अनेक वेळा प्रक्रिये घडल्याने लाव्हा रसाचे थरावर थर साचून खडक तयार होतात ,
- लाव्हा फ्लो असे ही म्हणतात
- बरच भाग या खडकाने बनलेला आहे चकचकीत व लहान छिद्रे असतात

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Extrusive Rocks, Products of Volcanoes बहिर्निर्मित/भूपृष्ठावरील अग्निजन्य खडक

Extrusive rocks form through the fast cooling of magma on or near the Earth's surface. Their structure and composition are closely related to the volcanic activity in the areas where they emerge. Because they are typically products of a fast solidification process, they usually have a very fine grain. When they are expelled from a volcano, they do not have a chance to crystallize before they cool, so they acquire a vitreous (glasslike) texture.

PUMICE
This rock is produced from lava with a high silicon and gas content, which gives it a foamy texture. This explains its porous consistency—acquired during rapid solidification—which enables it to float in water.



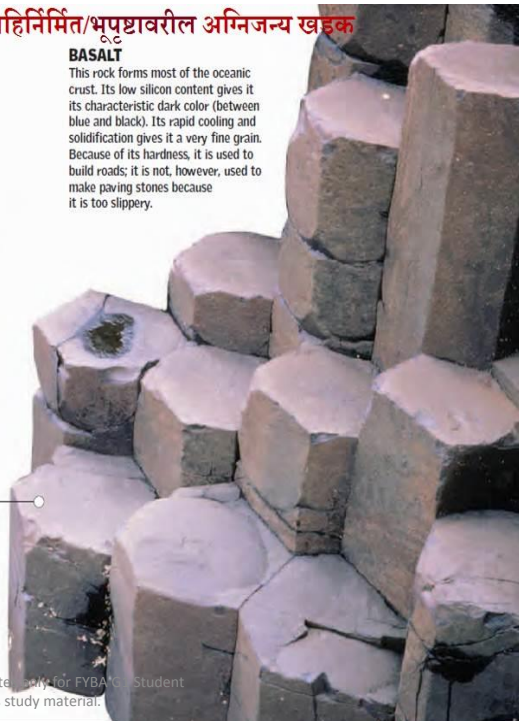
OBSIDIAN
This rock is black; its shades vary in accordance with its impurities. Because it undergoes rapid cooling, its structure is vitreous, not crystalline; thus, it is commonly called volcanic glass. Strictly speaking, obsidian is a mineraloid. It was often used to make arrowheads.

GEOMETRIC PRISMS
These prisms were formed in the Giant's Causeway (Northern Ireland) through contraction, expansion, and rupture of basaltic lava flows that crystallized gradually.

Hexagon

THE MOST COMMON SHAPE INTO WHICH BASALT CRYSTALLIZES

BASALT
This rock forms most of the oceanic crust. Its low silicon content gives it its characteristic dark color (between blue and black). Its rapid cooling and solidification gives it a very fine grain. Because of its hardness, it is used to build roads; it is not, however, used to make paving stones because it is too slippery.



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अंतर्निर्मित अग्निजन्य खडक:

- भूगर्भातील तप्त शिलारस भूपृष्ठावर न येता भूगर्भातील भेगा व पोकळ्यांमध्ये थंड होऊन तयार होणारी खडका म्हणजे अंतर्निर्मित अग्निजन्य खडक होत.

दोन प्रकार:

१. पातालिक खडक Plutonic rock:

- शिला रसा खूप खोलीवर थंड होऊन तयार होणारे खडक म्हणजे पतालिक.

२. उपपातालिक खडक: Hypabyssal Rocks

- शिलारस भूपृष्ठावर किंवा खूप खोलीवर थंड नहोता, त्या दरम्यान भूकवाचत थंड होऊन निर्मित खडकांना उपपातालिक खडक म्हणतात



अंतर्निर्मित अग्निजन्य खडक:

10/9/2017

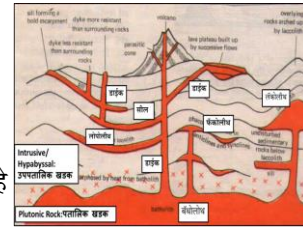
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१. डाईक:

लाव्हा रस भूकवाचतील उभ्या भेगात साचून थंड होतो उभ्या खडकांची निर्मिती होते त्यांना डाईक म्हणतात

२. सील व शीट:

- भूकवाचतील आडव्या मोठ्या किंवा अरुंद भेगांमध्ये शिलारस तांड होऊन निर्माण होणाऱ्या खडकांना अनुक्रमे सील व शीट म्हणतात, समांतर असतात
- **सील** जास्त लांबीचे व जाडीने असतात, समांतर असतात
- **शीट** पातळ किंवा कमी जाडीचे असते
- सील व शीट यांची लांबी काही किमी पर्यंत असते, इंग्लंड मधील व्हिनसील १.०० किमी लांबी ३० मी जाडी आहे



३. लॅकोलीथ:

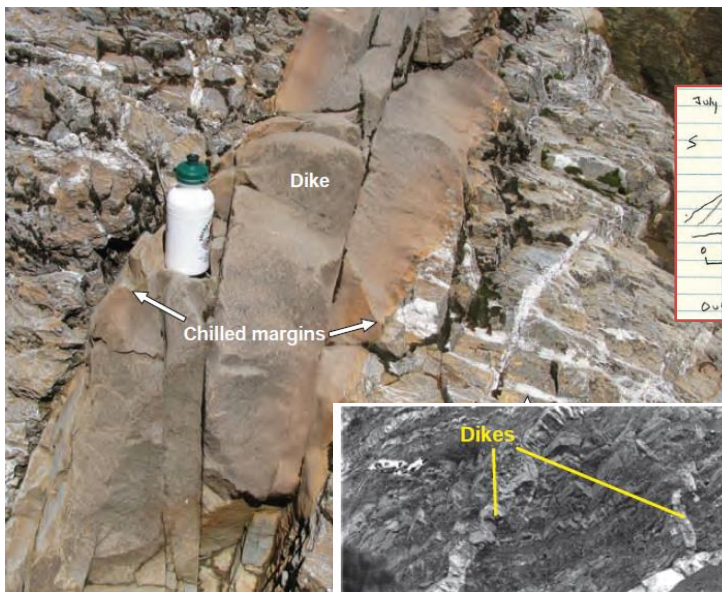
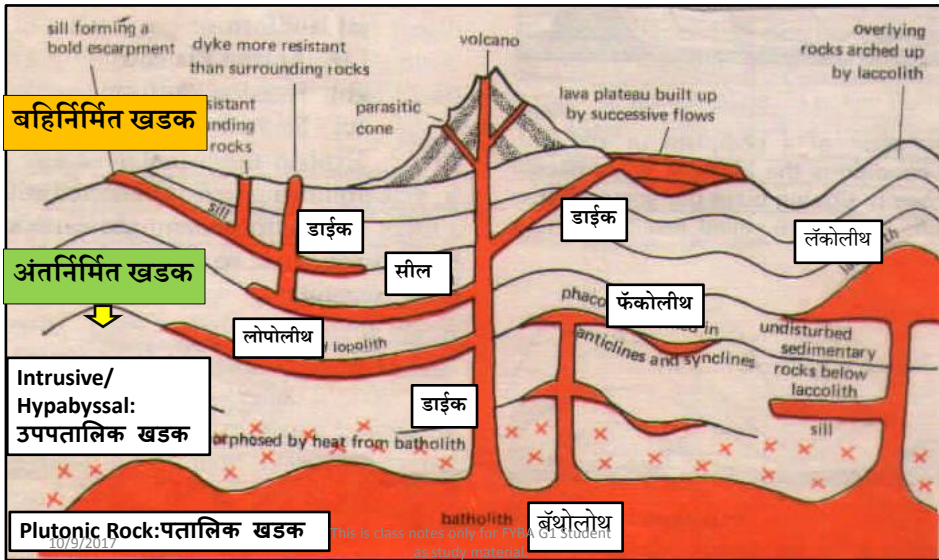
- शिला रस भूपृष्ठा कडे येताना, काही ठिकाणी खडक घुमटा सारखे वर उचलले जातात आणि निर्माण होणारी पोकळीत लाव्हा रस थंड होऊन कालांतराने घुमटाच्या आकारचे खडक तयार होतात त्यांना लॅकोलीथ म्हणतात

उदा. सं. सं. तील उटाह राज्यातील लासालपर्वत व हेनरी पर्वत

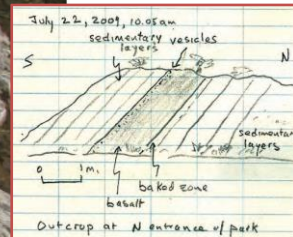
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अंतर्निर्मित अग्निजन्य खडक:
१.डाईक, २. सील-शीट, ३. लॅकोलीथ, ४. लोपोलीथ, ५.फॅकोलीथ, ६. बॅथोलोथ



डाईक:



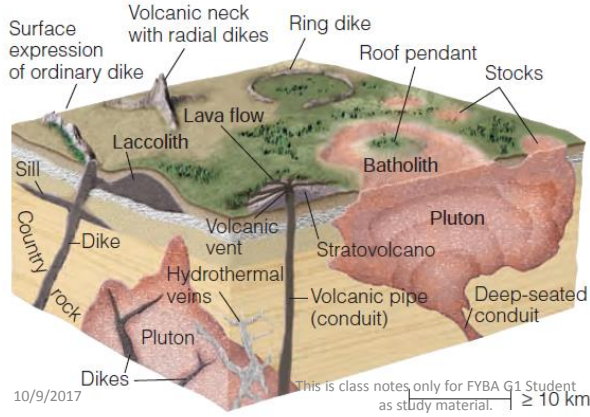
सील व शीट:



10/9/2017



large batholith occurs in the Sierra Nevada, California, including the granite batholith in Yosemite National Park



४. लोपोलीथ:

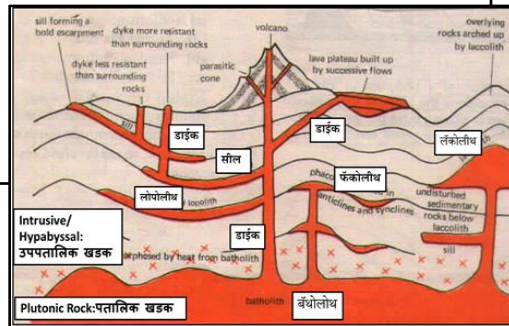
- जेव्हा लाव्हा रस खोलगट किंवा उथळ भागात साचून थंड होऊन बशीच्या आकारचे भूरूप निर्माण होते त्यास लोपोलीथ म्हणतात
- लोपोलीथ हा शब्द जर्मन भाषेतील लोपास (lopas) यावरून तयार झालेला आहे,
- ज्याचा अर्थ उथळ खोरे असा होतो

५. फॅकोलीथ:

- भूकवचातील खडकांना जेव्हा घडीचा आकार प्राप्त होऊन अपनती व अभिनतीट लाव्हा साचून वलयाकार भूरूप निर्माण होते त्यास फॅकोलीथ असे म्हणतात.

६. बॅथोलोथ:

- शिलारस वर येण्याचा प्रयत्न करतासतो तेव्हा भूकवचातील विस्तीरण पोकळी मध्ये शिलारसाचे निक्षेपण होते आणि खडक तयार होतात त्यांना बॅथोलोथ असे म्हणतात.



Underground: Plutonic or Intrusive Rocks

पतालिक/अंतर्निर्मित-अग्निजन्य खडक

MACROPHOTOGRAPHY OF PINK GRANITE

**गनाइट
GRANITE**
This rock is formed by big grains of feldspar, quartz, and mica. Its light-colored components indicate an abundance of silicon and that the rock is acidic. Because of its great resistance to wear, granite is often used as a construction material.

**गॅब्रो
GABBRO**
This rock contains ferromagnesian minerals, such as olivine, pyroxene, and augite, which form dark-colored crystallizations and feldspars, which give a white coloring to some of its parts. Gabbro generally solidifies slowly, leaving it with thick grains.

PERIDOTITE
This rock is mainly composed of olivine (which gives it a greenish color) and pyroxene. It is less than 45 percent silicon and is rich in magnesium, a very light metal. It is abundant in the upper layers of the mantle (at a depth of about 40 miles [60 km]) as a residue of old crust.

MACROPHOTOGRAPHY OF GRANODIORITE

GRANODIORITE
This rock is often confused with granite, but it is grayer since it contains larger numbers of quartz and sodic plagioclase crystals than it does feldspar. It has thick grains and contains dark crystals called nodules.

1 mile (1.6 km)
THE MINIMUM DEPTH AT WHICH GRANITE FORMS

Dikes and Sills: Rocks Formed in Seams

Some types of igneous rocks are formed from ascending magma that solidifies in seams or fissures. The resulting sheetlike body of rock is called a dike if it has a vertical orientation or a sill if it has a horizontal orientation. The composition of these rocks is similar to those of intrusive and extrusive rocks. In fact, like dikes and sills, intrusive and extrusive rocks can also form in cracks. However, the manner in which the materials in a sill or dike solidify causes them to form crystalline structures different from those of their volcanic and plutonic relatives.

PEGMATITE IS NATURALLY SMOOTH.

PEGMATITE
This very abundant, acidic rock has a mineral composition identical to that of granite. However, its solidification process was very slow, thus enabling its crystals to grow to a size of several feet.

CRYSTAL JOINED BY VITREOUS MASS

PORPHYRITICS
These rocks solidify in two phases. In the first, slower phase, thick phenocrystals form. Then in the second phase, the phenocrystals are dragged along by magma, which causes the formation of smaller, vitreous crystals. The name porphyritic alludes to the color purple.

लाव्हारसाच्या रासायनिक गुणधर्मानुसार अग्निजन्य खडकाचे दोन प्रकार:

१. आम्लधर्मी :

- सिलिकॉनचे प्रमाण ८०% असते + आयर्नऑक्साईड, अॅल्युमिनेयम व मॅग्नेशियम इ. २०% सिलीकाचे जास्त प्रमाण त्यामुळे घट्ट, म्हणून आम्लधर्मी. दूर अंतरावर पसरत नाहीत, उंच थर असतात उदा. ग्रॅनाइट

२. अल्कधर्मी:

- सिलीकाचे प्रमाण ४०% मॅग्नेशियम ४०%, आयर्न ऑक्साईड धरून इ. पदार्थ २०%
- सिलीकेचे कमी पर्मन –पातळ लाव्हा रस, अल्कधर्मी, दूर अंतर वाहून जातो, उदा. बेसाल्ट

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खनिज द्रव्यनुसार अग्निजन्य खडकाचे वर्गीकरण			
स्वाल्मुखी खडक : बारीक कण	 ट्रॅचोलाइट	 अॅन्डेसाइट	 बेसाल्ट
पत्तालिक खडक-मोठी कण	 ग्रॅनाइट	 डायोराइट	 गॅब्रो
संघटन	फिकट रंगाचे खनिजे क्वार्ट्झ व फेल्डस्पार	दोन्ही दरम्यानचे मिश्रण	गडद रंगाचे सिलिकेट – ओलीविन व प्यरॉक्सेन
जास्त सिलीका-युक्त मॅग्मा पासून			कमी सिलीका-युक्त मॅग्मा पासून

10/9/2017

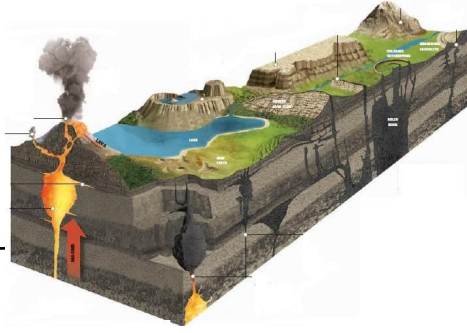
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खनिज द्रव्यनुसार		अग्निजन्य खडकाचे वर्गीकरण		
Volcanic (fine-grained) ज्वालमुखी खडक : बारीक कण				
	रहीवोलाईट Rhyolite	अँन्डेसाइट Andesite	बेसाल्ट Basalt	
Plutonic (coarse-grained) पतालिक खडक-मोठी कण				
	ग्रॅनाइट Granite	डायोराइट Diorite	गॅब्रो Gabbro	
Composition संघटन	फिकट रंगाचे खनिजे Felsic क्वार्ट्झ व फेल्डस्पार These rocks contain large portions of light-colored silicate minerals such as quartz and feldspar.	दोन्ही दरम्यानचे मिश्रण Intermediate These rocks have a mineral composition between that of rhyolite/granite and basalt/gabbro.	गडद रंगाचे सिलिकेट - ओलोविण व प्यॅरोक्सेन Mafic These rocks contain large portions of dark-colored silicate minerals such as olivine and pyroxene.	
	जास्त सिलीका-युक्त मॅग्मा पासून Higher silica content of magma	This is class notes only for FYBA G1 Student as study material.	कमी सिलीका-युक्त मॅग्मा पासून Lower silica content of magma	

Class	Subclass	Rock	General Characteristics
Igneous	Plutonic (Intrusive)	Granite	Coarse-grained: "salt & pepper" appearance; from high-silica felsic magma; plutonic equivalent of rhyolite.
		Diorite	Coarse-grained; from intermediate silica magma; plutonic equivalent of andesite.
		Gabbro	Coarse-grained; black or dark gray color; from low-silica mafic magma; plutonic equivalent of basalt.
		Peridotite	Common mantle rock consisting primarily of olivine and/or pyroxene.
	Volcanic (Extrusive)	Rhyolite	Light color; from high-silica felsic magma; volcanic equivalent of granite.
		Andesite	Typically gray in color; from intermediate silica magma; volcanic equivalent of diorite.
		Basalt	Usually black in color; from low-silica mafic magma; volcanic equivalent of gabbro.
		Obsidian	Volcanic glass; typically black in color and rhyolitic in composition.
		Pumice	Volcanic glass with frothy texture; often rhyolitic in composition.
		Tuff	Rock made from volcanic ash or pyroclastic flow deposits.

गुणधर्म:

- स्पटीकमय खडक
- निरनिराळ्या आकाराचे स्पटिक
- मोठे अवाढव्य आकार
- कठीण
- मजबू
- अच्छिद्र खडक – पाणी न मुरणे
- जैविक अवशेषांचा अभाव
- अने खानिजानीची उपलाब्दाता



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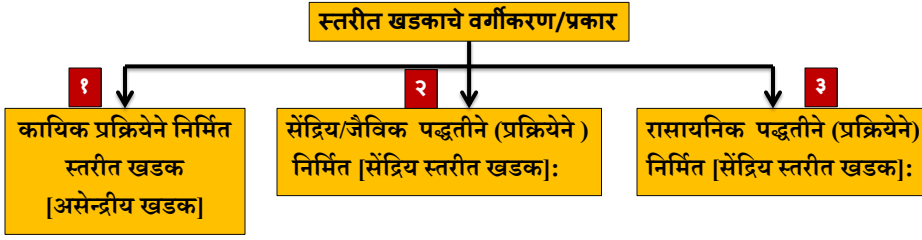
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२. स्तरीत/ जलजन्य/गाळाचे खडक: Sedimentary or Stratified Rocks

- पृथ्वीवरील मूळ/प्राथमिक खडकांवर भाय्य कारकांचा परिणाम होऊन, खडकांची मोठया प्रमाणावर झीज होती.
- झिजे मुळे खडकांचे वेगळे झालेले पदार्थ गाळाच्या रूपाने समुद्र, सरोवरे, नद्या इ. जलाशयात साचतात.
- गाळात सेंद्रिय व असेन्द्रीय पदार्थ असतात.
- समुद्रातील पाण्यातील सिलिका व क्वालसाईट मुळे गाळातील पदार्थ घट्ट बनतात व पाण्याच्या प्रचंड दाबामुळे एकसंघ होऊन जलजन्य किंवा स्तरीत खडक तयार होतात.
- हि क्रिया हळुवार होते. हजारो वर्षे गाळाचे थर साचत जाऊन दाबामुळे खडक बनतात.
- पाण्यात व पाण्याच्या दाबामुळे तयार होतात म्हणून “जलजन्य खडक” म्हणतात.
- गाळापासून तयार होतात म्हणून “गाळाचे खडक” म्हणतात.
- थरावर थर साचून बनतात म्हणून “स्तरीत खडक” म्हणतात.
- स्थरीय रचणे मुळे हे खडक इतर खाडका पेक्षा वेगळे आहेत.
- या खडकांची जाडी काही इंचा पासून ते काही फूटांपर्यंत असते.

10/9/2017

as study material.



स्तरीत खडकाचे वर्गीकरण/प्रकार:

- हे खडक निर्मिती प्रक्रियेनुसार व त्यात असलेल्या द्रव्याच्या मिश्रणानुसार त्यांचेपुढील प्रकार पडतात.

१. कायिक प्रक्रियेने निर्मित स्तरीत खडक [असेन्द्रीय खडक]

- इतर खडकांचे पदार्थकन [वाळू,माती,गाळ] एकत्रित येऊन हे खडक बनतात.
- असेन्द्रीय द्रव्यांचे प्रमाण जास्त. असेन्द्रीय पदार्थांच्या आधारावर प्रकार....

अ. रेती खडक: [Sand Stone]

- मूळ खडकांची कायिक पद्धतीने झीज होऊन बारीक रेती बनते.
- ग्रनाईट खडकातील क्वार्टझ वाळू कानांनी बनतो.
- वाहते पाणी, वारा इ.मुळे रेती वाहत जाऊन समुद्र तळ किंवा नदीत संचयित होते.
- पाण्यातील चिकट पदार्थांमुळे रेतीत घट्ट पानायेऊन रेती खडक बनतात.
- यांच्या रंग,पोत,मिश्रणात खूप फरक असतो,यांना वाळू खडक असेही म्हणतात.
- रेतीतील लहान मोठे गोटे चिकटून आंबडधाबड खडकाची निर्मिती होते त्यांना **गोटी [Conglomerate]** खडक

ब. पंकाश्म खडक [Clay]:

- नदीच्या पाण्या बरोबर वाहून आलेला अतिबारीक गाळाचे संचयन होऊन.
- थरावर थर साचून खडक तयार होतात ते.पंकाश्म खडक.
- या खडकांना शेल असे ही म्हणतात. अपरिपक्व खडक ही खूप मऊ असतात.

क.वायूजन्य खडक [Loess]:

- अतिसूक्ष्म मातीचे कण वाऱ्याबरोबर वाहत जाऊन संचयित होतात व थरावर थर साचून हवेच्या दाबामुळे थर घट्ट बनून खडक तयार होतात ते वायुजन्य खडक होत.

ड. टफ [Tuff]:

- ज्वालामुखीच्या उद्रेकातून बाहेर पडलेली राख,धूळ,इ.पदार्थांन टफ म्हणतात. समुद्रतळावर किंवा इ.जलाशयात टफचे संचयन होऊन निर्माण होणारे खडक टफ खडक म्हणून ओळखतात.

निर्मिती प्रकार	खडकाचे नाव	घटकद्रव्ये (Composition)
कायिक/यांत्रिक प्रक्रियांद्वारे निर्मित	1. पिंडाश्म (Conglomerates)	दगडगोटे - टोळगोटे
	2. कोणाश्म (Breccia)	कोणीत शकले
	3. वालुकाश्म (Sandstone)	वालुका कण सामान्यतः क्वार्टझ
	4. पंकाश्म (Shale)	सिल्ट अथवा माती
	5. मृत्तिकाश्म (Clays)	सूक्ष्म मातीचे कण

10/9/2017

२. सेंद्रिय पद्धतीने निर्मित [सेंद्रिय स्तरीत खडक]:

- प्राणी व वनस्पतींच्या अवशेषापासून निर्माण होणाऱ्या खडकांना सेंद्रिय स्तरीत खडक म्हणतात.
- असेन्द्रीय पदार्थ असतात परंतु सेंद्रिय पदार्थांचे प्रमाण जास्त असते.
- या खडकाचे दोन प्रकार आहेत.

अ.प्राणिजन्य सेंद्रिय खडक. [Calcareous Rocks]:

- समुद्रात असंख्य जीवजंतू असतात, त्यांच्या मृत्यू नंतर अवशेषांच्या संच्यातून निर्मित खडक-प्राणिजन्य खडक होत. यांचे दोन प्रकार

प्रवाळ खडक [Coral]:

- उष्णकटिबंधात उथळ समुद्रात प्रवाळ कीटकांची वाढ होते.
- हे प्रचंड प्रमाणात निर्माण होतात व मारतात.
- मृत प्रवाळ कीटकांचे संचयन होऊन जे खडक बनतात त्यांना प्रवाळ खडक म्हणतात.

१. चुनखडी खडक:[Limestone]

- उथळ समुद्रात किंवा गोड्या पाण्यात ही तयार होतात.
- नद्यांच्या पाण्यात क्वालिशियम कार्बोनेट क्षाराचे प्रमाण जास्त असते.
- हे क्षार समुद्रात साचतात, समुद्रातील प्राणी क्षार घेतात.त्यंची हाडे या क्षारणे बनतात, प्राणी मृत पावल्या नंतर,हाडातील क्षार संचयित होऊन खडक बनतात ते चुनखडक होत.

२. खडू [Chalk]:

- समुद्रातील फोरामिनिफोरा जातीच्या जीवजंतू पासून हे खडक बनतात.
- या जीवजंतूच्या शरीरात क्वालिशियम व सिलिका द्रव्याचे प्रमाण जास्त असते.
- मेल्या नंतर हाडांच्या सांगाड्या पासून खडू खडक बनतात.

10/9/2017

as study material.

ब. वनस्पतीजन्य खडक: [Carbonaceous]

- वनस्पतींच्या अवशेषापासून तयार होतात.
- दलदल भागातील किंवा जंगल प्रदेशातील वनस्पती, गाळ संचयनात गाडल्या जाऊन या खडकांची निर्मिती होते.
- या खडकात कार्बनचे प्रमाण जास्त असते.
- दगडी कोळसा या खडकाचे उत्तम उदाहरण आहे.
- गाडलेल्या वनस्पतींवर कमी जास्त दाब पडून निरनिराळे कोळसा प्रकार बनतात.
- अश्रूसाईट, बिटूमीनस, लिग्नाईट, पिट.

3. जैविक प्रक्रियांद्वारे निर्मित	1. चॉक/खडू	कॅल्शियम कार्बोनेट
	2. प्राणिज चुनखडी	प्राण्यांचे अवशेष
	3. डोलोमाइट व कोळसा	वनस्पतींचे अवशेष
	4. खनिज तेल	प्राणी व वनस्पतींचे अवशेष

10/9/2017

as study material.

Collection of Detrital Rocks

Among the sedimentary rocks, detrital rocks are the most abundant. They form through the agglomeration of rounded fragments (clasts) of older rocks. Depending on the size of the clasts, they are classified as (from smallest to largest) silt, lutite and limestone, sandstone, and conglomerates. The analysis of their components, cementation matrix, and arrangement in layers makes it possible to reconstruct the geologic history both of the rocks and of the areas in which they are found. Some break off easily and are used in industrial processes and construction as rock granules, whereas others are appreciated for their toughness and hardness.

Clay, Lime, and Ash

These materials form the less porous, fine-grained detrital rocks. Lutites are rocks of clay, composed of particles whose diameter does not exceed 0.0002 inch (0.005 mm). In general, they are compacted and cemented through chemical precipitation. Limestone rocks are also called limonites, named after limo, a sedimentary material with a somewhat thicker grain (up to 0.0025 inch (0.06 mm)). Some rocks composed of volcanic ash have a similar granulation. These rocks are very important in construction.



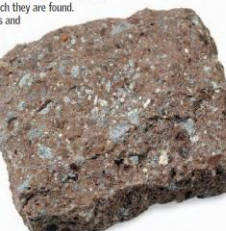
COMPACTED ASH
It is possible to find one or more layers of fine-grained pyroclastic material (volcanic ash) in many sedimentary rocks. Rocks formed from larger pyroclasts, which solidified in the air during an eruption before they touched the ground, are rarer. Their origin is igneous, but their formation is sedimentary.

40%
THE REDUCTION IN THE VOLUME OF CLAY AS IT IS COMPACTED

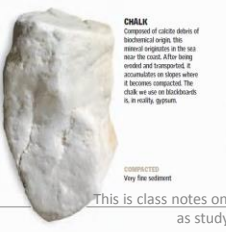


CLAY (KAOLINITE)
When hydrated, it increases in size.

CLAY
The substance commonly known as clay is an unconsolidated rock, made of hydrated aluminum silicates and typically full of impurities. Kaolin is the name for pure granular clay; it is soft and white and keeps its color even after it has been fired in a kiln. It has scale-shaped microcrystals and generally contains impurities.



TUFF
It is rock that is formed from deposits of volcanic ash that has been cemented together. There are several types: crystalline tuff, which is largely composed of igneous glass; lithic tuff, which contains rock fragments; and hybrid tuff, which is formed from fragmented volcanic material combined with some clay.



CHALK
Composed of calcite debris of biochemical origin, the mineral originates in the sea near the coast. After being eroded and transported, it accumulates on slopes where it becomes compacted. The chalk we use on blackboards is, in reality, gypsum.

COMPACTED
Very fine sediment

A Variety of Sandstones

Sandstone is a rock composed of grains that are mostly between 0.003 and 0.08 inch (0.08 and 2 mm) in size. Sandstones are classified according to their mineral composition, their level of cementation (or geologic history), and the proportion of cementation material they contain. Quartz-cemented limestones are more than 90 percent quartz. Lutite limestones are mostly hydrated, and sandstone limestones are cemented by iron compounds, and pyroclasts belong to this class of rocks.

SANDSTONE
It is made up of small pieces of sand that are here classified by color and texture. This type of sandstone indicates that an alternating process of sedimentation involving two types of particles has occurred.

GRAYWACKE

has a similar proportion of calcium carbonate, quartz, feldspar, and mica. It differs from common sandstone because it contains a higher amount of cementation material (more than 15 percent), which forms its grain matrix. This makes it more compact.

Conglomerates

Most of the grains that compose these rocks are larger than 0.08 inch (2 mm). In some cases, it is possible to identify with the unaided eye the primary rocks from which a conglomerate is formed. As a result, it is possible to determine the areas where the sediments originated, accumulations of grain and cementation material can indicate other slopes in the rocks where the conglomerates formed or the action of fluvial currents. All this information makes it possible to reconstruct the geologic history of a rock.



MESOPHOTOGRAPH OF BRECCIA

CONGLOMERATE
formed by large fragments, they are good examples of sediments that have been compacted after sandstone. The irregularity of the grains' and clast points to a chaotic origin, which could be related to debris associated with a glacial recession.

BRECCIA

The grains are thick but with straight angles and edges. This shows that the sediments have not been fired and that cementation has taken place near the area from which the materials originated.

85%
PERCENTAGE OF CLASTS LARGER THAN 0.08 INCH (2 MM)

Some break off easily and are used in industrial processes and construction as rock granules, whereas others are appreciated for their toughness and hardness.

Clay, Lime, and Ash

These materials form the less porous, fine-grained detrital rocks. Lutites are rocks of clay, composed of particles whose diameter does not exceed 0.0002 inch (0.004 mm). In general, they are compacted and cemented through chemical precipitation. Limestone rocks are also called limonites, named after limo, a sedimentary material with a somewhat thicker grain (up to 0.0025 inch (0.06 mm)). Some rocks composed of volcanic ash have a similar granulation. These rocks are very important in construction.



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40%
THE REDUCTION IN THE VOLUME OF CLAY AS IT IS COMPACTED

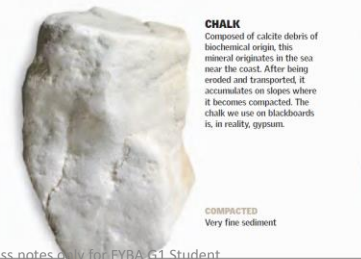


CLAY (KAOLINITE)
When hydrated, it increases in size.

CLAY
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COMPACTED
Very fine sediment

10/9/2017

This is class notes only for FYBA G1 Student as study material.

A Variety of Sandstones

Sandstone is rock composed of grains that are mostly between 0.003 and 0.08 inch (0.06 and 2 mm) in size. Sandstones are classified according to their mineral composition, their level of compaction (or geologic history), and the proportion of cementation material they contain. Quartzarenite (which is more than 95 percent quartz), arkose (which is mostly feldspar), red sandstone (which is cemented by iron compounds), and graywacke belong to this class of rocks.

SANDSTONE
is made up of small grains of sand that are loose stratified by color and texture. This type of sandstone indicates that an alternating process of sedimentation involving two types of particles has occurred.

ARKOSE
possesses a varied composition, although it contains up to 25 percent quartz and feldspar. Generally, it has a porous consistency, and less than one percent of its interstices are empty. In this specimen, the pinkish section is composed of feldspar, and the white portion is quartz.

GRAYWACKE
has a defined proportion of calcium carbonate, quartz, feldspar, and mica. It differs from common sandstone because it contains a higher amount of cementation materials (more than 15 percent), which form its grain matrix. This makes it more compacted.

Conglomerates
Most of the grains that compose these rocks are larger than 0.08 inch (2 mm). In some cases, it is possible to identify with the unaided eye the primary rocks from which a conglomerate is formed. As a result, it is possible to determine the areas where the sediments originated. Accumulations of gravel and cementation material can indicate either slopes in the rocks where the conglomerates formed or the action of fluvial currents. All this information makes it possible to reconstruct the geologic history of a rock.

CONGLOMERATE
Formed by large fragments, they are good examples of sediments that have been compacted after landslides. The irregularity of this specimen's clasts points to a chaotic origin, which could be alluvial in nature or associated with a glacial moraine.

BRECCIA
Its grains are thick but with straight angles and edges. This shows that the fragments have had time to fall and that cementation has taken place over the area from which the materials originated.

20% OF SEDIMENTARY ROCKS ARE SANDSTONES.

85% PERCENTAGE OF CLASTS LARGER THAN 0.08 INCH (2 MM)

MICROPHOTOGRAPH OF BRECCIA

10/9/2017

Coal Formation

Plant remains, such as stems, twigs, herbs, and leaves, accumulated in swamps or continental basins 200 million years ago. Submerged in sludge and protected from oxygen in the air, the material slowly became enriched with carbon through the action of anaerobic bacteria.

Transformation of Vegetation into Hard Coal

1. Vegetation

Organic compounds on the surface become covered by water and mud, forming a peat bog, in which effectively preserved from oxidation.

2. Peat

Through partial putrefaction and carbonization in the dark interior of the peat bog, the organic matter changes into coal.

Contains 60% carbon

3. Lignite

is formed from the compression of peat that has been subjected to a certain degree of heat and moisture. Some primary plant structures can still be recognized in it.

Contains 70% carbon

4. Coal

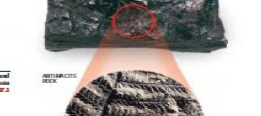
is a product of less than 10 percent mineral substance on the basis of dry material. It has a relatively high carbon content, and is dark in color and is only in the black.

Contains 80% carbon

5. Anthracite

is the type of coal with the highest concentration of carbon. Its high heat value is mostly due to this type of coal's high carbon content and low concentration of volatile materials. It is harder and denser than ordinary coal.

Contains 95% carbon



LOCATION INSIDE THE EARTH

Vegetation in a swampy area after 6000 years.

Peat in a bog after 1000 years.

Coal in a bog after 1000 years.

Coal in a bog after 1000 years.

Coal in a bog after 1000 years.

Coal in a bog after 1000 years.

Coal in a bog after 1000 years.

Coal in a bog after 1000 years.

Coal in a bog after 1000 years.

Coal in a bog after 1000 years.

Coal in a bog after 1000 years.

The minerals of the earth's crust are deposited in layers. The thickness of these layers varies from a few centimeters to several kilometers. The layers are separated by boundaries. The boundaries are of two types: primary and secondary.

TEMPERATURE

TEMPERATURE

TEMPERATURE

TEMPERATURE

TEMPERATURE

TEMPERATURE

TEMPERATURE

TEMPERATURE

TEMPERATURE

TEMPERATURE

WORLD COAL RESERVES

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

WORLD PETROLEUM RESERVES

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

Global Reserves

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This is clay

३. रासायनिक प्रक्रियेतून निर्मित स्तरीत खडकः

- वाहत्या पाण्यात ठराविक रासायनिक पदार्थ विरघळतात, या पाण्याचा खडकांवर परिणाम होऊन खडक विरघळतात, या पाण्याचे बाष्पीभवन होऊन रासायनिक पदार्थ संचयित होऊन खडक तयार होतात त्यांना रासायनिक खडक म्हणतात.

रासायनिक प्रक्रियांद्वारे निर्मित	1. जिप्सम	(Gypsum)	कॅल्शियम सल्फेट
	2. क्षार	(Salt)	सोडियम क्लोराइड
	3. कॅल्करस टूफा	(Calcareous tufa)	लाईमचे कार्बोनेट
	4. लोह धातुक	(Iron)	बॉग लोहधातुक

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गुणधर्मः

- पाण्यात निर्माण होतात.
- वेगवेगळे थर असतात.-समांतर आडवे उभे थर
- थरांची जाडी काही इंचा पासून फुटा पर्यंत असते.
- विशेष टणक नसतात.-मृदू खडक असतात
- अनेक आकाराचे कण संघटीत
- अनेक प्रकारचे खनिज
- रंग वेगवेगळा असतो'
- प्राणी व वनस्पतींचे अवशेष/जीवाश्म आढळतात.

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रुपांतरित खडक

खडकांचे प्रकार

रुपांतरित खडक - अग्निज आणि स्तरित खडकांवर खूप उष्णता किंवा प्रचंड दाब यांचा परिणाम होऊन त्याचे स्वरूप बदलते व वेगळाच स्तरित खडक तयार होतो. त्या खडकास **रुपांतरित खडक** असे म्हणतात.

वैशिष्ट्ये -

१. रुपांतरित खडकांत धातू खनिजे सापडतात.
२. रुपांतरणाची क्रिया घडत असताना मूळ खडकांची रासायनिक घटना सहसा बदलत नाही.
३. मूळ खडकांचा रंग, आकार, रचना यात बदल होतो.

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उदा.

खडकाचा प्रकार	मूळ खडकाचे नाव	खडकाचा प्रकार
अग्निज खडक	ग्रॅनाईट	ग्रॅनाईटनीस
अग्निज खडक	बेसाल्ट	हॉनब्लेंड शीस्ट
स्तरित खडक	चुनखडक	संगमरवर
स्तरित खडक	कोळसा	ग्राफाईटयुक्त कोळसा
स्तरित खडक	वाळूचा खडक	क्वार्ट्झाइट
स्तरित खडक	शेल	स्लेट - मायका शिस्ट



ग्रॅनाईटनीस

रुपांतरित खडक

10/9/2017



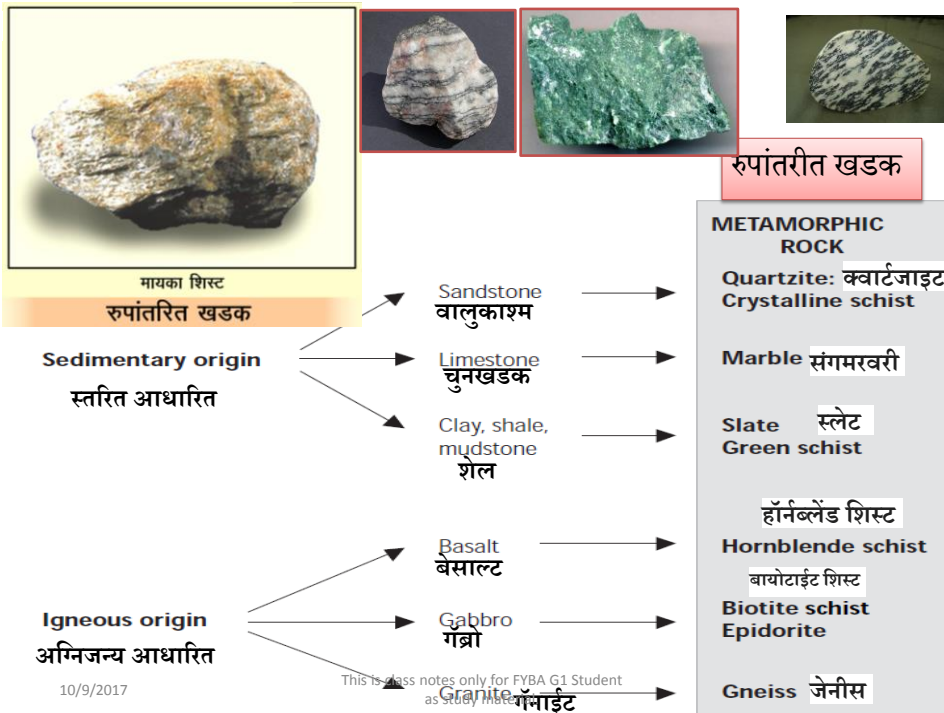
हॉनब्लेंड शिस्ट

रुपांतरित खडक

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संगमरवरी रुपांतरित खडक	ग्राफाइटयुक्त कोळसा रुपांतरित खडक
	
क्वार्ट्जाइट रुपांतरित खडक	स्लेट रुपांतरित खडक

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Common Metamorphic Rocks

The classification of metamorphic rocks is not simple because the same conditions of temperature and pressure do not always produce the same final rock. In the face of this difficulty, these rocks are divided into two large groups, taking into account that some exhibit foliation and others do not. During the transformation process, the density of rock increases, and recrystallization can induce the formation of bigger crystals. This process reorganizes the mineral grains, resulting in laminar or banded textures. Most rocks derive their color from the minerals of which they are composed, but their texture depends on more than just their composition.



SLATE
Its black color comes from the carbon in organic matter present in sediments.

Slates and Phyllites

These foliated rocks crystallized under moderate pressure and temperature conditions. Slate has very fine grained rocks of small mica crystals. It is very useful in the production of roof tiles, floor tiles, blackboards, and tablet covers. It almost always is formed through low grade metamorphism in sediments and less often from volcanic ash. Phyllite represents a gradation in metamorphism between slate and schist; it is composed of very fine mica crystals, such as muscovite or chlorite.



PHYLLITE
Similar to slate, it is suitable for its silky luster.



SLATE
Because of exfoliation, it tends to break into flat sheets.

Foliation

LAMINATED OR STRIPED TEXTURE, RESULTING FROM THE PRESSURE TO WHICH THE ROCK WAS SUBJECTED

GARNETIFEROUS SCHIST
This rock's name comes from its components. Schist intensifies its texture and general color and distinctive features.



MICACIOUS SCHIST
Its characteristic coloring is determined by colorless or white muscovite crystals.

HORNBLÉNDE SCHIST
It contains some sulfides as well as considerable amounts of iron and aluminum.

Gneiss

These are rocks that usually contain large and granular minerals. The most common types are quartz, potash feldspar, and plagioclase. It can also have smaller amounts of muscovite, biotite, and hornblende. Its characteristic stripes are due to a segregation of light and dark silicates. Gneiss rock, which has a mineral composition similar to that of granite, is formed through secondary processes or derived from igneous rocks. However, it can also form through high-grade metamorphism of schists. It is the last rock of the metamorphic sequence.

Stripes

MAKE IT POSSIBLE TO DETERMINE THE DIRECTION IN WHICH PRESSURE WAS EXERCISED ON THE ROCK.

Schist

This rock is more prone to foliation, and it can break off in small sheets. It is more than 20 percent composed of flat, elongated minerals, which typically include mica and amphiboles. For schist to be formed, a more intense metamorphism is needed. The different schistose rock's names and characteristics depend on the predominant mineral that composes them or on the one that produces exfoliation. Among the most important schistose rocks are mica, hornblende, and talc. Because this type of rock has different layers, it has been used in sculpture.

0.04 inch (1 mm) OR MORE, THE SIZE OF MICA GRAINS IN SCHIST—LARGE ENOUGH TO SEE WITH THE UNAIDED EYE.

QUARTZITE
It is hard and tough; it is compacted because the quartz grains cement.



MARBLE
It is highly valued for its texture and color. It is used in sculpture and architecture.



Marble and Quartzite

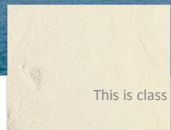
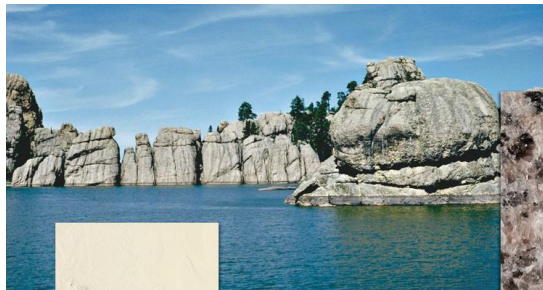
These rocks are compacted and recrystallized. Marble is a thick-grained crystalline rock, derived from limestone or dolomite. Because of its color and toughness, marble is used in the construction of large buildings. Quartzite is a very hard rock, usually made of calcite or quartz. Quartzite is normally white, but some rocks can give it a reddish or pinkish tone.

7 IS THE LEVEL OF HARDNESS OF QUARTZITE.



MARBLE MICROGRAPH
Impurities and accessory minerals color the marble.

धन्यवाद



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सामान्य जलजन्य खडकांचे वर्गीकरण

निर्मिती प्रकार	खडकाचे नाव	घटकद्रव्ये (Composition)
1. कायिक/यांत्रिक प्रक्रियांद्वारे निर्मित	1. पिंडाश्म (Conglomerates)	दगडगोटे - टोळगोटे
	2. कोणाश्म (Breccia)	कोणीत शकले
	3. वालुकाश्म (Sandstone)	वालुका कण सामान्यतः क्वार्ट्झ
	4. पंकाश्म (Shale)	सिल्ट अथवा माती
	5. मृत्तिकाश्म (Clays)	सूक्ष्म मातीचे कण
2. रासायनिक प्रक्रियांद्वारे निर्मित	1. जिप्सम (Gypsum)	कॅल्शियम सल्फेट
	2. क्षार (Salt)	सोडियम क्लोराइड
	3. कॅल्करस टूफा (Calcareous tufa)	लाईमचे कार्बोनेट
	4. लोह धातुक (Iron)	बाँग लोहधातुक
3. जैविक प्रक्रियांद्वारे निर्मित	1. चॉक/खडू	कॅल्शियम कार्बोनेट
	2. प्राणिज चुनखडी	प्राण्यांचे अवशेष
	3. डोलोमाइट व कोळसा	वनस्पतींचे अवशेष
	4. खनिज तेल	प्राणी व वनस्पतींचे अवशेष

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Extrusive Rocks, Products of Volcanoes

Extrusive rocks form through the fast cooling of magma on or near the Earth's surface. Their structure and composition are closely related to the volcanic activity in the areas where they emerge. Because they are typically products of a fast solidification process, they usually have a very fine grain. When they are expelled from a volcano, they do not have a chance to crystallize before they cool, so they acquire a vitreous (glasslike) texture.

PUMICE

This rock is produced from lava with a high silicon and gas content, which gives it a foamy texture. This explains its porous consistency—acquired during rapid solidification—which enables it to float in water.

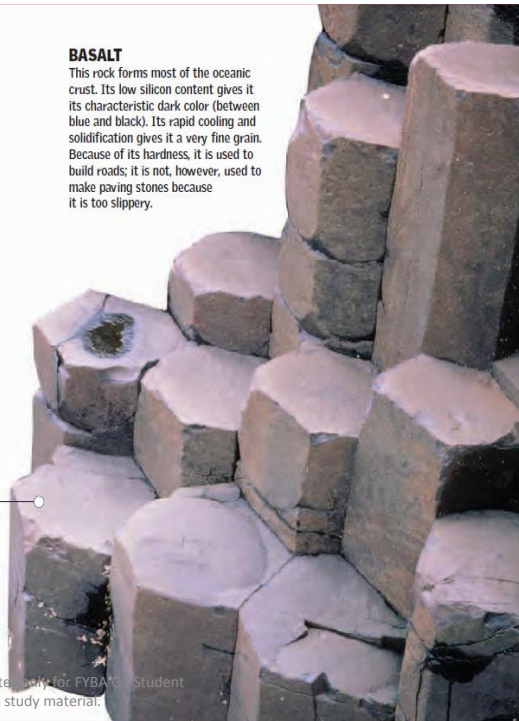


OBSIDIAN

This rock is black; its shades vary in accordance with its impurities. Because it undergoes rapid cooling, its structure is vitreous, not crystalline; thus, it is commonly called volcanic glass. Strictly speaking, obsidian is a mineraloid. It was often used to make arrowheads.

BASALT

This rock forms most of the oceanic crust. Its low silicon content gives it its characteristic dark color (between blue and black). Its rapid cooling and solidification gives it a very fine grain. Because of its hardness, it is used to build roads; it is not, however, used to make paving stones because it is too slippery.



GEOMETRIC PRISMS

These prisms were formed in the Giant's Causeway (Northern Ireland) through contraction, expansion, and rupture of basaltic lava flows that crystallized gradually.

Hexagon

THE MOST COMMON SHAPE INTO WHICH BASALT CRYSTALLIZES

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Underground: Plutonic or Intrusive Rocks

Rocks of this type formed through the solidification of magma masses deep within other rocks. In general, they have undergone a slow cooling process in the Earth's crust, which has permitted the formation of pure mineral crystals large enough to be seen with the unaided eye. Usually they display a compact structure and have low porosity. Depending on the composition of the magma, there are acidic plutonic rocks (rich in silicon) or basic rocks (with low silicon content). Granite is the most common type of intrusive rock.



MACROPHOTOGRAPHY OF PINK GRANITE

GRANITE
This rock is formed by big grains of feldspar, quartz, and mica. Its light-colored components indicate an abundance of silicon and that the rock is acidic. Because of its great resistance to wear, granite is often used as a construction material.

1 mile
(1.6 km)

THE MINIMUM DEPTH AT WHICH GRANITE FORMS



GABBRO
This rock contains ferromagnesian minerals, such as olivine, pyroxene, and augite, which form dark-colored crystallizations, and feldspars, which give a white coloring to some of its parts. Gabbro generally solidifies slowly, leaving it with thick grains.



PERIDOTITE
This rock is mainly composed of olivine (which gives it a greenish color) and pyroxene. It is less than 45 percent silicon and is rich in magnesium, a very light metal. It is abundant in the upper layers of the mantle (at a depth of about 40 miles [60 km]) as a residue of old crust.



MACROPHOTOGRAPHY OF PERIDOTITE

GRANODIORITE
This rock is often confused with granite, but it is grayer since it contains larger numbers of quartz and sodic plagioclase crystals than it does feldspar. It has thick grains and contains dark crystals called nodules.