

ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશન

# ખનિજ પત્રિકા

એસોસિયેશન સમાચાર

વોલ્યુમ - ૮

નં. - ૮

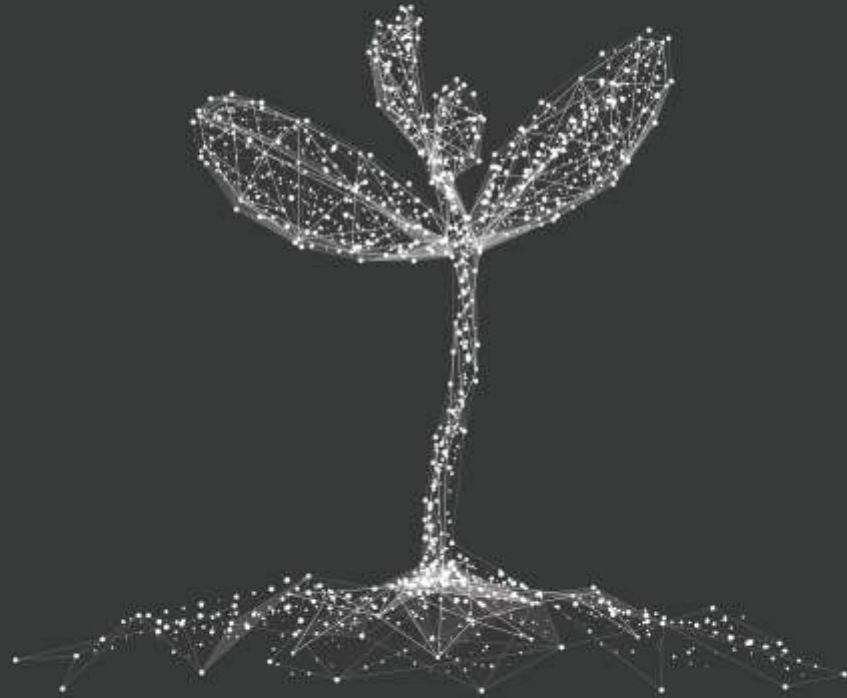
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## તાંબ્રિક સલાહકાર મંડળ

૧.	શ્રી સી.એમ. દ્વિવેદી	..	પ્રમુખ અને તંત્રી
૨.	શ્રી બિરેન પટેલ	..	મેમ્બર અને તંત્રી
૨.	શ્રી કે. એન. પટેલ	..	મેમ્બર
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૬.	ડૉ. ડી. એન. પંચોલી	..	મેમ્બર
૭.	શ્રી જયમિત સોલંકી	..	મેમ્બર



**શ્રી સી. એમ. દ્વિવેદી**  
પ્રમુખ

### ઉપપ્રમુખ

શ્રી જય જી. શાહ  
શ્રી જતીન પટેલ

### માનદ મંત્રી:

શ્રી હર્ષવર્ધન ભાવાની

### સંયુક્ત માનદ મંત્રી

શ્રી દીપક પંડ્યા  
શ્રી વિમલ કુભાવત

### ખજાનચી

શ્રી જશુભાઈ જી. પટેલ

## ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશન

સ્થાપના: સને ૧૯૬૨

વર્ષ	પ્રમુખ	માનદ મંત્રી
૧૯૬૩-૭૦	નટવરલાલ શામળદાસ વોરા	કૃષ્ણપ્રસાદજેડ. પટેલ
૧૯૭૧-૭૨	પ્રભુદાસ વિદુલદાસ માખેયા	દેવેન્દ્રભાઈ ડી. બધેકા
૧૯૭૩	જશવંતભાઈ યુ. ત્રિવેદી	ગોવિંદભાઈ બી. શાહ
૧૯૭૪-૭૫	જયંતીલાલ ડી. પટેલ	ગોવિંદભાઈ બી. શાહ
૧૯૭૬	જયેન્દ્રભાઈ બી. પટેલ	ગોવિંદભાઈ બી. શાહ
૧૯૭૭-૭૮	જયેન્દ્રભાઈ બી. પટેલ	ગોવિંદભાઈ બી. શાહ
૧૯૭૯-૮૦	ઈન્દુભાઈ એસ. જાની	ગોવિંદભાઈ બી. શાહ
૧૯૮૧-૮૨	જયેન્દ્રભાઈ બી પટેલ	ગોવિંદભાઈ બી. શાહ
૧૯૮૩-૮૫	ગોવિંદભાઈ બી. શાહ	મધુભાઈ એ. શાહ
૧૯૮૬-૮૭	જશવંતભાઈ યુ. ત્રિવેદી	મધુભાઈ એ. શાહ
૧૯૮૮-૯૧	સુરેન સી. ચોકસી	મધુભાઈ એ. શાહ
૧૯૯૨-૯૭	જીતેન્દ્રભાઈ ડી. ત્રિવેદી	ગિરીશ આર. પટેલ
૧૯૯૭-૯૯	ગોવિંદભાઈ બી. શાહ	બિરેન જે. પટેલ
૧૯૯૯-૦૬	રાવજીભાઈ જે. પટેલ	બિરેન જે. પટેલ
૨૦૦૬-૧૦	બિરેન જે. પટેલ	જતીન આર. પટેલ
૨૦૧૦-૧૨	હંસરાજ ડી. પટેલ	જતીન આર. પટેલ
૨૦૧૩-૧૫	હંસરાજ ડી. પટેલ	સી. એમ. દ્વિવેદી
૨૦૧૬-૧૮	પી. એન. રાવ	સી. એમ. દ્વિવેદી
૨૦૧૯-૨૨	પી. એન. રાવ	જય જી. શાહ
૨૦૨૨-૨૪	સી.એમ. દ્વિવેદી	હર્ષવર્ધન ભાવાની

## સંકલિત ખનિજ મંડળ

૧. પોરબંદર ચોક માર્થન્સ ઓનર્સ એન્ડ મેન્યુફેક્ચરર્સ એસોસિયેશન
૨. કચ્છ ચાઈનાકલે એસોસિયેશન
૩. કચ્છ માર્થન્સ મિનરલ્સ એન્ડ ઈન્ડસ્ટ્રી એસોસિયેશન
૪. અમદાવાદ સેન્ડ લીઝ હોલ્ડર એસોસિયેશન
૫. ગાંધીનગર ડિસ્ટ્રિક્ટ સેન્ડ એસોસિયેશન
૬. અંબાજી માર્બલ ક્વોરી એન્ડ ફેક્ટરી એસોસિયેશન
૭. છોટાઉદેપુર માર્થન્સ ઓનર્સ એસોસિયેશન
૮. છોટાઉદેપુર ડિસ્ટ્રિક્ટ સેન્ડ એસોસિયેશન
૯. નવસારી ક્વોરી એસોસિયેશન
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૧૨. સાઉથ ગુજરાત લીઝ હોલ્ડર એસોસિયેશન, સુરત
૧૩. ગુજરાત ગ્રેનાઈટ એસોસિયેશન
૧૪. હાલોલ ક્વોરી એસોસિયેશન
૧૫. ગોધરા ક્વાટર્સ એસોસિયેશન

## કોર્પોરેટ સંકુલ:

૧. ડી.સી.ડબલ્યુ. લિમિટેડ
૨. ગુજરાત અંબુજા સિમેન્ટ્સ લિમિટેડ
૩. નિરમા લિમિટેડ
૪. સાંઘી ઈન્ડસ્ટ્રીઝ લિમિટેડ
૫. આશાપુરા માર્બલ્સ લિમિટેડ
૬. અલ્ટ્રાટેક સિમેન્ટ લિમિટેડ
૭. ગુજરાત હેવીકેમિકલ લિમિટેડ
૮. ટાટા કેમિકલ્સ લિમિટેડ
૯. કાર્બોરેન્ડમ યુનિવર્સલ લિમિટેડ
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૧૫. એચ. ડી. એન્ટરપ્રાઇઝ
૧૬. વિમલ માર્બલ્સ લિમિટેડ
૧૭. હાઈબોન્ડ સિમેન્ટ (ઈ) પ્રાઈવેટ લિમિટેડ
૧૮. ૨૦ માર્બલ્સ લિમિટેડ
૧૯. ગુજરાત ઈન્ડસ્ટ્રીઝ પાવર કંપની લિમિટેડ
૨૦. આશાપુરા કેલ્સાઈન એન્ડ રિફ્રેક્ટરીઝ એલ.એલ.પી.
૨૧. વાન બેન્ટ મિનરલ્સ પ્રાઈવેટ લિમિટેડ
૨૨. ઓરિએન્ટ એબ્રેસીવ લિમિટેડ
૨૩. સૌરાષ્ટ્ર કેલ્સાઈન બોકસાઈટ એન્ડ એલાઈડ ઈન્ડસ્ટ્રી લિમિટેડ
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## અનુક્રમણિકા

- ૦૧ એડવર્ટઈઝમેન્ટ - રઘુવંશી રિફ્રેક્ટરીઝ
- ૦૨ એડવર્ટઈઝમેન્ટ - ટાટા કેમિકલ્સ લિમિટેડ
- ૦૫ પ્રમુખસ્થાનેથી
- ૦૬ ફોટોગ્રાફ્સ - નવનિયુક્ત કમિશ્નરશ્રી સાથે એસોસિયેશનના હોદ્દાદારોની મુલાકાત
- ૦૭ Article - Mineral Resources in Gujarat
- ૨૫ Reserve of Important Minerals in Gujarat
- ૨૬ ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશનની વિજ્ઞાપ્તિ
- ૨૭ એડવર્ટઈઝમેન્ટ - બોરોસીલ રિવ્યુઅલ્સ
- ૨૮ એડવર્ટઈઝમેન્ટ - આશાપુરા ગ્રૂપ ઓફ ઈન્ડસ્ટ્રીઝ

લેખકો દ્વારા દર્શાવાયેલાં અભિપ્રાય-મંતવ્ય 'ખનિજ પત્રિકા'ના પ્રકાશક, તંત્રી અને "ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશન"નાં નથી. પત્રિકામાં છપાયેલ કોઈ પણ સાહિત્યનું પુનઃ પ્રકાશન અનુમતિ સિવાય કરવું ખાસ વર્જિત છે.

પત્રવ્યવહારનું સરનામું :

સંપર્ક: સેક્રેટરી, ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશન,  
બીજો માળ, માર્બલ એન્ડ મિનરલ ચેમ્બર્સ,  
ડી. કે. હાઉસ પાછળ, મીઠાખળી, અમદાવાદ-૩૮૦ ૦૦૬.  
ટેલિ.: ૦૭૯-૨૬૪૨ ૭૦૪૭ ઈ-મેઈલ: gujmin@gmail.com

મુદ્રક : પ્રિન્ટ વિઝન પ્રા. લિ.

આંબાવાડી, અમદાવાદ. • ફોન: ૦૭૯-૨૬૪૦ ૫૨૦૦



સી.એમ. દિવેદી  
પ્રમુખ

માનનીય સભ્યશ્રીઓ,

આપ સર્વ સમક્ષ આ 'ખનિજ પત્રિકા'નો અંક રજૂ કરતાં આનંદની લાગણી અનુભવું છું. ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશન દ્વારા આ વખતે ઈન્ડસ્ટ્રિયલ મિનરલ્સ નો પરિચય આપવાનો પ્રયાસ કરેલ છે.

ગુજરાત રાજ્યમાં જુદાં જુદાં મુખ્ય ખનિજોની ૪૩૩ માઈનિંગ લીઝ અને ૭૩૭૬ ગૌણ ખનિજની ક્વોરી લીઝ મળી કુલ ૭૮૦૯ લીઝ અસ્તિત્વ ધરાવે છે. આ લીઝમાંથી વર્ષ ૨૦૨૨-૨૩ માં રાજ્ય સરકારશ્રીને રોયલ્ટી ડેડરેન્ટ પેટે રૂ. ૨૦૩૩.૪૦ કરોડની રેકોર્ડ મહેસૂલ આવક પ્રાપ્ત થયેલ છે તેમજ ખનિજ આધારિત ઉદ્યોગના ઉત્પાદન દ્વારા અન્ય કરવેરા પેટે સરકારશ્રીને આવક પ્રાપ્ત થાય છે. રાજ્ય સરકારશ્રીને ડિસ્ટ્રિક્ટ મિનરલ ફાઉન્ડેશન પેટે તા. ૨૬-૯-૨૦૧૬ થી તા. ૩૧-૩-૨૦૨૩ સુધીમાં રૂ. ૧૩૮૭.૪૦ કરોડ આવક પ્રાપ્ત થયેલ છે.

'આત્મનિર્ભર ભારત' માટે ખાણ મંત્રાલયે ખાનગી ક્ષેત્રની મોટી ભૂમિકા માટે ખાણ ક્ષેત્રે માળખાકીય સુધારા લાવવાનો નિર્ણય લીધેલ છે તે ખુબ જ આવકાર્ય છે, જેનાથી રોજગારીની તકો ઊભી થશે. કેપ્ટિવ અને નોન-કેપ્ટિવ ખાણ વચ્ચેનો તફાવત દૂર કરવા ખનિજોની કિંમત નક્કી કરવા અને સ્ટેમ્પડ્યુટીને તર્કસંગત બનાવવા ઉપરાંત ડી.એમ.એફ. અને એન.એમ.ઈ.ટી.ની કામગીરીની સમીક્ષા જરૂરી છે. ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશન તે માટે પ્રયાસ કરે જ છે. આ સુધારા ખાણકામ ક્ષેત્રને જીવંત બનાવશે. ખાસ કરીને અંતરિયાળ વિસ્તાર અને આદિજાતિ વિસ્તારોમાં રોજગારીની તકોમાં વધારો થવા પામશે.

વધુમાં શ્રી ડી. કે. પટેલ, આઈ.એ.એસ.ની ભૂસ્તર વિજ્ઞાન અને ખનિજખાતાના કમિશ્નર તરીકે નિયુક્તિ થતાં તા. ૨૪-૪-૨૦૨૩ ના રોજ ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશનના હોદ્દેદારો અને સિનિયર સભ્યશ્રીઓ દ્વારા નવનિયુક્ત કમિશ્નરશ્રીને આવકારવા સૌજન્ય મુલાકાત લીધેલ, જેમાં શ્રી એચ.પી. પટેલ, અધિક નિયામકશ્રી (વિકાસ) પણ હાજર રહેલ. તેઓશ્રીને એસોસિયેશનની કામગીરી

અંગે જાણકારી આપી ખનિજ ઉદ્યોગને લગતાં અગત્યના ૧૨ જેટલા પ્રશ્નોની રજૂઆત કરવામાં આવી. કમિશ્નરશ્રી દ્વારા દરેક પ્રશ્નો અને સૂચનોને ખુબ જ સહાનુભૂતિપૂર્વક સાંભળવામાં આવેલ, જેમાં તેઓશ્રીનું વલણ ખુબજ હકારાત્મક અને સહકારભર્યું રહેલ. એસોસિયેશન દ્વારા તેઓશ્રીને ખનિજ ઉદ્યોગને લગતા રજૂ કરેલ પ્રશ્નો અને બીજા અન્ય પ્રશ્નો અંગે વિગતવાર ચર્ચા-વિચારણા હાથ ધરવા સમય આપવા વિનંતી કરેલ. આ અંગે એસોસિયેશનના સભ્યશ્રીઓને ખનિજ ઉદ્યોગને લગતા વહીવટી, નીતિવિષયક અને નાણાકીય બોજરૂપ હોય તેવા પ્રશ્નોના ઉકેલ અંગે તર્કબદ્ધ સૂચનોસહ રજૂ કરવા જણાવવામાં આવેલ.

સરકારશ્રીના ઉદ્યોગ અને ખાણ વિભાગ, ગાંધીનગરના ઠરાવ તા. ૩૦-૧૨-૨૦૨૧ થી ગૌણ ખનિજના હયાત રોયલ્ટી/ડેડરેન્ટના દરમાં સુધારણાની વિચારણા કરવા કમિશ્નરશ્રી, ભૂસ્તર વિજ્ઞાન અને ખનિજના અધ્યક્ષપણા હેઠળ સમિતિની રચના કરવામાં આવેલ તેની બેઠક તા. ૦૨-૦૫-૨૦૨૩ના રોજ કમિશ્નરશ્રીના અધ્યક્ષપણા હેઠળ રાખવામાં આવેલ, જેમાં એસોસિયેશનના હોદ્દેદારો દ્વારા હાજર રહી લેખિત તથા રૂબરૂમાં તર્કબદ્ધ રજૂઆત કરવામાં આવેલ, જેમાં શ્રી કે. એન. પટેલ, ચેરમેન, લીગલ કમિટી દ્વારા તૈયાર કરવામાં આવેલ તલસ્પર્શી લેખિતમાં રજૂઆત બદલ તેઓશ્રીના આભારી છીએ. ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશનનો પ્રયાસ છે કે ડેડરેન્ટ અને રોયલ્ટીના દર માફકસર જેથી તર્ક સંગત રહે અને તે લીજધારક પર બોજ ના બને.

વધુમાં એસોસિયેશનના પ્રમુખ તરીકે મેનેજિંગ કમિટીના સભ્યશ્રીઓ તથા આપ બધા સભ્યશ્રીઓ તરફથી મળી રહેલ સહકાર બદલ સૌ સભ્યશ્રીઓનો આભાર વ્યક્ત કરું છું.

શુભેચ્છા સાથે,

સી. એમ. દિવેદી  
પ્રમુખ



Photographs taken on the occasion of introductory meeting of GUJMIN Officials with Shri Dhaval K. Patel, newly appointed Commissioner, Geology & Mining Department, at his office on 24-4-2023.

Shri C.M. Dwivedi, President, Gujmin Industry Association presenting Bouquet to Shri Dhaval K. Patel, Commissioner, Geology & Mining Department.



Gujmin Officials with Shri Dhaval K. Patel, CGM



## Mineral Resources in Gujarat

By Gujmin Team

### Major Minerals



**Bauxite** is basically a hydrated aluminium oxide with varying proportions of Iron oxide, Silica and generally Titania. Hydrated aluminium oxides present in the bauxite are diaspore and bohemite,  $Al_2O_3 \cdot H_2O$  ( $Al_2O_3$ -85%, Al-45%); gibbsite or hydragillite,  $Al_2O_3 \cdot 3H_2O$  ( $Al_2O_3$ -65.4%, Al-34.6%) and bauxite (containing colloidal alumina hydrogel),  $Al_2O_3 \cdot 2H_2O$  ( $Al_2O_3$ -73.9%, Al-39.1%) Iron oxide in bauxite ore is present as hematite or goethite, Silica occurs partly as clay and partly as free quartz and titania occurs in the form of leucosene or rutile. Bauxite is an essential ore of aluminium metal which is one of the most important non-ferrous metal used in the modern industry. Bauxite occurs as lumps, boulders and pebbles of variegated colors ranging from ash grey to white to pink or red. Hardness is highly variable. The specific gravity is generally around 2.5 to 2.6. Clayey varieties are also common.

The bulk of bauxite production (about 90%) all over the world is used for the production of aluminum metal. Other uses are in abrasive and refractory industries. Many chemicals such as alum and other compounds are produced from Bauxite. A recent use is as a flux in iron and steel industry. Some varieties are used as absorbents also. In cement industry bauxite is also used to some extent.

Bauxite in Gujarat occurs as segregated pockets in laterite. It occupies a stratigraphic Position denoting either a "Paleocene" or "Post Laki-Gai" age. Kuchchh and Jamnagar districts have the major deposits of the state. Usually it occurs as boulders, embedded in a lithomarge layer. Some massive bedded deposits are also known; it outcrops at the surface without any overburden and is the youngest member of the laterite profile. The average thickness is about two meters, the range varies from a few centimeters to as much as 10 meters, and lateral extent of the bauxite patches is also highly

variable. Softcloy varieties occur below the tertiary formation at depth varying three meters to as much as 30 meters.



**Limestone** is a rock composed mainly of Calcium Carbonate present in a finely divided non-crystalline state as in amorphous limestone or as crystallised grains of mineral calcite as in Crystallize limestone. Limestone often contains some Magnesium Carbonate, either as dolomite  $CaMg(CO_3)_2$  or magnesite ( $MgCO_3$ ) mixed with Calcite. They are then termed 'dolomitic' or 'magnesium' limestone and they contain 10 to 40%  $MgCO_3$ . Limestone altered by dynamic or contact metamorphism become coarsely crystalline and are referred as 'marbles' and 'crystalline limestone'. Other common varieties of limestone are 'malstone' impure limestone containing varying proportions of clay; oolite (oolitic limestone) composed wholly or partly or small spherical concentric layers. 'Chalk' a white extremely fine grained usually soft and friable variety of limestone, composed wholly or largely of microscopically small remains of foraminifera and broken shelly fragments 'kankar' irregular modules and concretion of impure Calcium Carbonate, of all size found in the older surface alluvium or soils, trovertina (Calc-tufa or calcerous sinter) Calcium Carbonate rock deposited from solutions in limestone regions by spring waters and stalagmites and stalactites, Calcium Carbonate deposits on the floor and roof of caves in limestone regions by percolating water. The two other varieties of limestone are 'hydraulic limestone' which when burnt gives lime or cement which sets or hardens under water and lithographic limestone, a uniformly fine textured, compact but sufficiently porous and soft limestone used in lithography in the form of rectangular slabs.

- Limestone is mostly used in manufacture of cement.

- High grade limestone is used for the manufacture of bleaching powder Soda ash, caustic, soda, calcium carbide etc.
- Blast furnaces utilize limestone as a flux in pig iron and steel, textiles and sugar industries.
- It is also used in glass, paper, soap, rubber.

Limestone occurs almost in all stratigraphical horizons in Gujarat States Archaean limestones are exposed in Panchmahals and Sabarkantha districts Limestone belonging to Ajabgarh group of Delhi Supergroup occur in Banaskantha, Sabarkantha and Mehsana districts. Light grey, yellowish limestone marls, Oolitic and coralline limestone occur in islands of Patcham, Khadir, Bela in Rann in Wagad Area, and in Jura and Helaman hills. These belong to Jurassic age. Lameta limestones are spread over parts of Kheda, Panchmahals and Sabarkantha districts. Nummulitic limestone of Eocene age occurs on the Western fringe of Deccan traps in Bharuch and Surat districts. The other extensive deposits are in Western parts of Kuchchh district and Milliolic limestone occurs in the coastal tract of Saurashtra. Kand limestone of Miocene is found in Konda near Ankleshwar. Small scattered patches of similar limestone belonging to Gaj age occur in coastal area of Saurashtra. Dwarka limestone occurs in Okha mandal area of Jamnagar district. Tufa and Kanker of recent age occur almost in all parts of the state.



**Lignite** is a type of coal, which forms due to accumulations of carbonaceous material derived from vegetation undergone to a process of compaction and slight heating during burial. In general a series of stage

under the process of coalification it forms. It is a low carbon content composition. Lignite is a soft, loose, brown in colour moisty fragmental aggregate of vegetable material. It is a high combustion lignite loses its calorific potential when comes in direct contact with atmosphere. Specific gravity is 1.1 - 1.4 and hardness is 2.0 - 2.5.

There are four lignite deposits in Gujarat State, the Kachchh lignite deposit at Panandhro and Bhuri lignite deposit in Jhagadia taluka of Bharuch district.

Ghogha lignite deposits in Bhavnagar district, Tadkeshwar lignite deposit in Surat district. At Panandhro in Kachchh the lignite coal seams are found to occur in the Eocene formation of Tertiary sediments. At Bharuch the lignite seams are associated with Tadkeswar formation ranging from Upper Eocene to Oligocene age. At Surat the occurrence of lignite confined to Cambay shale of lower Eocene age. The shale is intercalated with Vaglladkhol formatioin which is resting above Deccan Trap, while at Bhavnagar the lignite is confined Eocene age. The overall overburden ratio, Kuchchh deposit is 1:6 and Bharuch deposit is 1:9. In the district Panandhro, Kaiyari, Akrimota, Matanomadh, Umarsar, Jhulrai, Vegapadar, Lakhpat, Lifri, Dhadedi and Nana Ratadia are the explored localities by Geology and Mining as well as by G.S.I. The Panandhro lignite deposit is a working lignite mines by Gujarat Mineral Development Corporation, Gujarat State, in Lakhpat taluka of the district. At Bhuri, Maljipura, Rajparadi, Mandva, Sinada, Deshad, Tuna, Umargam, Vandoria, Rajgarh, Choramali, Daheli, Dharoli, Valia, Vitthalgam, Sodgom, Amod, Ratanpur of Bharuch districts are main location where significant lignite deposits have been found. G.M.D.C. has been exploiting lignite deposits in Rajparadi. Tadkeshwar, Mangrol, Vastan, Nani Naroli, Rozwad are main villages of the Surat district where the lignite deposits has been explored. The Gujarat Industries Power Corporation exploiting these deposits and directly using in their captive power plant. Ghogha, Gundi, Nana Ratanpur, Mota Ratanpur, Khadasalia, Bhadbhadia, Lakhanka and surrounding areas or the prime location where department has explored huge quantity of lignite.



**Manganese ore** is important in an industrial economy as manganese in alloy forms is an essential input in steel making. Manganese ore is Pyrolusite ( $MnO_2$ , Mn 63.2%), Psilomelane (Manganese oxide of uncertain composition, containing water and varying amounts of oxides of Ba, K and Na, Mn commonly 45-60%), Brunite ( $3 Mn_2O_3$ ,  $MnSiO_3$ , Mn about 62% and  $SiO_2$  about 10%) and Manganite



(Mn<sub>2</sub>O<sub>3</sub>, H<sub>2</sub>O, Mn 62.4%) minerals. It also occur in the form of lenses and as veins and also found in the form of kidney shape. Manganese ore deposits occurs as bedded sedimentary (metamorphosed) deposits associated with Archeans of Gujarat. Geological Survey of India have noted Manganese occurring in few areas of Halol taluka of Panchmahals district and other places of Vadodara district. Based on this geological survey, Klick Nikson & Co., a British Co. had obtained a lease in around year 1907 and started activities of mining. Manganese was obtained by surface mining and also an underground at places. After obtaining Mn ore by scientific mining, it was exported to abroad.

### Coal (Sub-Bituminous)



Coal is one of the chief 'fossil fuel' or mineral fuels and is an important source of heat and energy. In Gujarat coal so far explored is of subbituminous type except lignite as in case of Kachchh, Bharuch, Bhavnagar & Surat district. Coal forms a series of ingredients based upon the carbon content and stages of the coal forming process which ends at the Anthracite. It is characterized by its black colour, and on weathering breaks parallel to the bedding plane unlike the bituminous coal which breaks up in to cube. It shows a distinctly pitchy and often a conchoidal fracture. It contains 12-25% moisture. Sub bituminous coal is a good fuel, igniting easily and with calorific value ranging from 8000-10000 (BTU). The specific gravity is 1.3 - 1.7 and hardness is 2 - 2.5. In Gujarat Subbituminous type of coal is found associated with the Umia sandstone and shale formation of upper most Jurassic to Albion in age as in case of Surendranagar district and in case of Kachchh district it is found associated with the upper Jurassic to Cretaceous sedimentary like brownish Sandstone bands and light grey colored Sandstone.

### Minor Minerals



#### Agate

It is a variegated chalcedony. The colours are either (a) banded or (b) irregularly clouded or (c) due to

visible impurities as in moss agate, which has brown mass like or dendritic forms, as of manganese oxide, distributed through the mass. The bands are delicate parallel lines, off white, pale and dark brown bluish and other shades; they are sometimes straight more often waving or zigzag and occasionally concentric circular. The agate have been formed by a deposit of silica from solutions intermittently supplied, in irregular cavities in rocks and deriving their concentric waving courses from the irregularities of the walls of cavity. Massive, cryptocrystalline form of quartz, typically in volcanic lavas as a cavity filling, having been deposited by silica rich aqueous solutions. The colour variation and banding may be due to slight changes in the composition of the solutions and of the physical conditions in the lava during deposition. Specific gravity about 2.6 and hardness is 6.5 - 7.

### Soap Stone



Steatite the massive compact cryptocrystalline variety of high grade talc and soapstone the massive talcose rock of variable talc content (usually 50%) soft and soapy to feel. Commonly it may contain minerals as the impurities like other minerals such as Quartz, Calcite, Dolomite, Magnesite, Serpentine, Chlorite Tremolite etc. Composition of talc is very uniform. The extreme softness results from the absence of bonding except by weak van-der Waals forces between the layers. Soapstone is a massive variety of talc, mostly white or grey of various shades, sometimes greenish or reddish talc or soapstone, in colour greyish grey, light green, ivory grey or brownish black. As a filler for paint, paper, rubber etc. and in plaster, foundry-facing and lubricants for removing grease from cloths etc. Soapstone slabs are used in switch boards, sinks, laboratory table tops, acid tank etc. harder variety are carved into ornaments. The occurrence of Steatite is intimately associated with asbestos is altered ultrabasic rocks, dolomites and actinolite schists. It is mainly noticed in Kundal valley in Sabarkantha district. The valley is about 1.5 to 2.00 km length with an average width of 100 mts. and surrounded by low parallel ridges of Delhi Quartzites. There are

9 pockets of soapstone deposits. As secondary mineral formed as a result of the alteration of olivine, pyroxene and amphibole, being often derived from ultrabasic igneous rocks. Often in schist produced by low or medium grade metamorphism of magnesian rocks, in association with actinolite, less commonly as a result of thermal metamorphism of dolomitic limestone. The soapstone occurs in village Bhamner of Bhiloda taluka and Kundoi village of Modasa taluka of Sabarkantha district.

Several soapstone pockets were delineated around Ghata village of Sabarkantha. The soapstone pockets were exposed to an average depth of 1.8 mts. and average width is about 4.6 mts. and the length is about 7.00 mts to 30 mts. Apart from these the soapstone is also reported from Chalvad, Gandhra, Vav, Duma, Narukot and Ranjitpara in Jambughoda and Godhra talukas of Panchmahals district. Few occurrences also reported from Vadodara district.



**Quartz** is one of the commonest in all minerals, abundant and widely distributed, occurring in most igneous, metamorphic and sedimentary rocks, sometimes composing almost all of the rocks.

Rock making quartz is white though shades of gray and dark smoky gray or brown to black. The term 'quartz' is often referred to as a synonym for Silica. Silica ( $\text{SiO}_2$ ) is one of the ubiquitous material in the earth's crust. Quartz, Quartz Crystals, Quartzite, Silica sand, Sand (others) and moulding sand are all coined in one generic name 'Silica minerals'. This is because all these commodities are essentially crystalline silicon dioxide ( $\text{SiO}_2$ ) with variations mostly related to their crystal size or minor to trace impurities.

'Silica' occurs in several form and when crystalized, quartz occurs as hexagonal prisms with its prism faces often horizontally striated.

Quartz is colourless when pure, otherwise variously coloured with greasy luster and is resistant to weathering and insoluble in acids except hydrofluoric acid. On heating at  $575^\circ\text{C}$ , Quartz

(Alpha-Quartz) inverts to high temperature quartz (Beta-Quartz) which further invert at  $870^\circ\text{C}$  to tridymite and this at about  $1470^\circ\text{C}$  passes into cristobalite and finally to a Silica melt at  $1710^\circ\text{C}$  to  $1756^\circ\text{C}$ . The important varieties of crystalline quartz are vein quartz, milky quartz, ferruginous quartz, Aventurine quartz cat's eye, rock crystal, amethyst, transparent quartz, besides rock quartz, smoky quartz etc. The Crystallized common rock making quartz is pure silica  $\text{SiO}_2$  but certain massive varieties of silica, such as jasper and opal, which are not crystallized or not apparently so, are of common occurrence and take part in forming rocks, contain in addition more or less combined water, white impurities like clay and oxide of iron are generally present and give them distinctive colors. The average specific gravity is 2.65. Its hardness is 7, very important property. Quartz crystals often show faces very irregularly developed, and are often distorted. Occasionally crystals contain small cavities partially or wholly Silica with liquid. Quartz also occurs massive, granular and sometimes stalactitic. Luster-vitreous occasionally resinous, transparent to opaque, fracture-conchoidal. It is also a refractory material, special types of crystalline varieties have electrical properties. The total estimated reserves are 4 Million tonnes. Out of which, 3 Million tonnes in Panchmahal district and 1 Million tonnes in rest of the districts.



**Laterite** is a surface formation that is enriched in iron and aluminium. Found mainly in hot, wet tropical areas, it develops by intensive and long-lasting weathering of the underlying parent rock. The mineralogical & chemical composition of laterite depends on their parent rock. Due to the presence of iron oxides, lateritic soils are red in colour ranging from light bright to brown shades. The term 'laterite' was originally used for highly ferruginous deposits first observed in Malabar Region of coastal Kerala and Dakshina Kannada & other parts of Karnataka. It is a highly weathered material, rich in secondary oxides of iron, aluminium or both. It is either hard or capable of hardening on exposure to moisture and drying. The laterite deposits may be described on

the basis of the dominant extractable minerals in it:

- Aluminous laterite (Bauxite)
- Ferruginous laterite (Iron ore)
- Manganiferous laterite (Manganese ore)
- Nickeliferous laterite (Nickel ore)
- Chromiferous laterite (Chrome ore)

Laterite occurrences are widespread in the country. Almost all Indian bauxite deposits are associated with laterite, except those in Jammu & Kashmir. The total reserves/resources of laterite were estimated at 706 million tonnes, out of these 124 million tonnes are placed under Reserves category and 581 million tonnes are under Remaining Resources category. Major share of about 74% resources is located in two states, namely, Madhya Pradesh (55%) and Rajasthan (17%). The remaining 28% of resources are spread over in the States of Andhra Pradesh, Kerala, Gujarat, Maharashtra and Jharkhand.

- Indian Standards code IS 3620-1979 provides specifications and standards for laterite masonry construction in India.
- The compact and ferruginous variety of laterite is used widely as a building stone and road metal.
- Limited capacity to withstand heavy pressure has limited the use of laterites in construction of light structures, partition walls, boundary walls, etc.
- Laterite as a building stone possesses one advantage that it is soft when quarried and can be easily cut and dressed into blocks and bricks which on exposure to air become hard.
- The industrial use of laterite is in the Cement Industry. It is used as an additive for lowering the clinkerisation temperature and supplementing aluminous and iron contents required in the manufacture of cement.

The consumption of laterite in cement has scaled up due to increased demand of cement in the country. The plausibility of diverse application of laterite in future could well become a viable source for metallic minerals like iron, aluminium, and chromite.



**Ball clay** commonly consists of 20-80% kaolinite, 10-25% mica & 6-65% quartz. Ball clay and china clay differ only in the degree of plasticity. Ball clay is a highly plastic variety of kaolin having high binding power, tensile strength and shrinkage. It is utilised generally after mixing with non-plastic clay to impart the desired plasticity in pottery, porcelain and refractory materials. It also helps in the preparation of glaze, enamels and for imparting a dense vitrified body. Deposits of ball clays are relatively scarce due to the combination of geological factors needed for their formation. The total resources of ball clay in the country are placed at 134.74 million tonnes. Out of these resources, the reserves are about 49.49 million tonnes and the remaining resources are 85.25 million tonnes. About more than 57% resources are in Rajasthan followed by Andhra Pradesh with 42%. Resources in Gujarat are nominal. Out of the total reserves/resources, Ceramic/Pottery grade constitutes 58%.

### Base Metal Ore



The classification of metals in to different groups is sometimes confusing earlier, it was the practice to group metals in to the noble metals, ferrous metals and base metals. In the first group were included gold, silver, platinum etc. which do not tarnish or oxidise on exposure and hence occurred in nature in the native State. The second group comprises iron, nickel, cobalt etc. while the third covers a metals like copper, lead, zinc, etc. which normally get oxidized and are tarnished. Strictly speaking, the ferrous metals may also be included in base metal group if the definition is rigidly adhered to. In practice, the term's base metals and non-ferrous metals are almost synonymous in commerce and trade. Copper, lead, zinc, tin and aluminium are mainly covered under this group though aluminium strictly speaking belongs to the category of light metals.

Base Metal is blackish in colour, seems soft but extremely tough metal, very ductile and malleable.

The lusture is metallic, specific gravity is 8.94 and hardness is 2.5 to 3. At Ambaji village of Banaskantha district the mineralized zones consist of an intercalated series of talc-schist, biotite-quartz schist and rarely epidote-quartz schist. The mode of occurrence of base-metal minerals is varied as...massive galena-sphalerite, pyrite-chalcopyrite lodes and thick stringers in talc-schist; or as thin veins of pyrite-chalcopyrite in biotite rich lenticels along the foliation. This is by far the largest deposit of base-metal found in Gujarat. The total estimated reserve is 8.5 million tons in Banaskantha. The average base-metal concentration in the ore is 1.53 % Copper, 3.33 % Lead and 5.35 % Zinc.

In addition there are also evidence of base-metal, traced out in the ultrabasic of Sabarkantha, Champaner series of rocks in Narukot, Gandia, Ranjitpura of Jambughoda taluka of Panchmahal district and Nathpur, Dahod, Javi of Dahod taluka of Dahod district. Quartz veins traversing Deccan trap at Banejnes of Junagadh district and associated with the fluorite deposits of Vadodara district. The reserves of this deposits are not assessed.



**Bentonite** are very fine grained clays. They vary in color from cream to olive green. Bentonite shows conchoidal or sub-conchoidal fracture; can be easily cut with knife into thin shavings. It shows waxy lustre

on freshly cut surface and are soapy to feel. Bentonite is an important naturally occurring clay of great commercial importance. Based on water absorbing qualities in industry, bentonite are known as swelling and non-swelling types. The swelling types absorbs large quantities of water, swells enormously in the process and remains in suspension for a long time in dilute water dispersions. The non-swelling absorbs water slightly more than ordinary plastic clays. It does not swell much and settles rapidly in dilute suspensions. There are all gradations between two types. The swelling type is highly colloidal and known as sodium montmorillonite bentonite, whereas non-swelling types are calcium montmorillonite bentonite. The swelling property is reversible, i.e.

the bentonite can be dried and re swelled again and again. In Gujarat, Bhavnagar and Kuchchh districts have major occurrence of bentonite. The deposit in Kuchchh is regarded as one of the world's best deposits.

The bentonite deposits of the state are associated with the basaltic flows of Deccan trap formations. In many major area such as Kuchchh, they occur below the lateritic horizon. They are observed to prefer the amygdaloidal variety. The bentonite varies in thickness from about three to ten meters and occurs in the form of lenses, pockets or oval shaped bodies. When occurring thin soil cover (generally 1.5 to 3.0 meters) it causes the soil at surface to be cracked up and gives a spongy feeling to a person walking on such ground. The state has a number of deposits in Kuchchh, Bhavnagar, Amreli, Sabarkantha, Jamnagar, Banaskantha, Mehsana etc. of these Bhavnagar and Kutch have the major deposits. All the deposits are not fully assessed at present. However, the Geology and Mining has assessed 40.25 Million Tonnes of all grades in Bhavnagar district and 65 Million Tonnes has been assessed in Kuchchh District. The estimated reserve in Gujarat is 105 Million tonnes.

Exploitation of Bentonite is done in all the above districts, Pulverising units are in operation in Bhavnagar, Bhuj, Gandhidham and Ahmedabad. Gujarat has consistently increased its Bentonite production and now occupies a leading position in the country. which alone accounted for 88% of the total value of Bentonite produced in the country.



**Calcite** is a carbonate of calcium ( $\text{CaCO}_3$ ) containing 56%  $\text{CaO}$  and 44%  $\text{CO}_2$ . It is one of the important industrial minerals also known by 'Calc Spar'. Pure crystallized transparent variety of Calcite is known as 'Iceland Spar' which is used in optical instruments using polarized light. Calcium carbonate  $\text{CaCO}_3$  small quantities of magnesium, iron, manganese, zinc and lead may be present replacing the calcium. It is colorless or white, sometimes with grey, yellow, blue and red tints. It has vitreous to earthy luster. It can be scratched by knife, Hardness-3 and specific gravity is 2.7. It shows

conchoidal fracture and is infusible, becoming highly luminous when heated. It gives effervescence with evolution of carbon dioxide in cold dilute acid. As regards colour, crystallised calcite varies from the kinds which are perfectly clear and colourless through yellow, pink; purple, blue, to brown and black. The colour is usually pale except as caused by impurities. The transparent variety from Iceland, used for polarising prisms etc., is called Iceland spar or Doubly-refracting spar. Calcite in its wide variety of occurrence has many uses. The clear transparent material has long been used for optical purposes particularly in the constructions of polarizing prisms. Calcite or limestone has been burned to quicklime (CaO) slaked to hydrated lime  $[Ca(OH)_2]$  & mixed with sand to make mortar.

It also finds wide use in chemical industries and as a fertilizer. Portland cement now widely used in concrete for building purpose. Further it finds use in metallurgical processes for smelting both iron and non-Ferrous metals. It is also used to remove impurities in the slag. It is used in the manufacture of bleaching powder ammonia, calcium carbide, pottery, sugar, tooth pastes, tooth powders and other pigments. It is also used in cement, ceramic glass, cosmetics, pharmaceuticals and chemical industries. It is used as a filter in rubber, textile and paper industries, crystals are also used in petrological microscope.

During mining, calcite is sorted out to different grades depending upon the colour. Most of the mine owners sell calcite to pulverizing units for crushing and marketing.

Powder form of calcite is used as fillers in many industries like textiles, rubber and paint. It is also used as a carrier in insecticide preparations. The glass and ceramic industries are the principal consumers. In ceramic industries, it forms an important constituent of certain glazes and enamels. White to super white quality of calcite of 300 mesh is used for such purposes except for glass where the size range required is 40-50 mesh. Tata Fission Ltd. Bombay is an important consumer of calcite for insecticide formulations. Other uses of calcite are in manufacture of cement, fluxing agent in the manufacture of electrodes. The electrodes

industry is an important consumer of calcite in India. Manufacturers prefer calcite of 98 % purity in power form of 200-230 mesh. The  $SiO_2$ , P and S should not exceed 2, 0.01 and 0.035 percent respectively. Calcite is however not regarded indispensable and can easily be replaced by material like chalk. The transparent and clear crystal known as "Iceland spar" is highly valued for use in optical instruments. It is largely used in the manufacture of Nicol-Prism for polarized light in petrological microscope. Crystals are picked up from mines in Jamnagar district.

Consumption of Calcite in domestic industry is less. It is less than 20,000 tonnes/year. Glass & Ceramics account for 50% of the total consumption.

### Chalk



Gujarat is the only state in India producing the chalk. The term chalk is applied to the very fine grained pure white limestone. However, the term is occasionally used to designate the similar fine grained limestones which are not stratigraphically same as in Western Europe. Good quality of chalk is concentrated around Adityana in Porbandar district. It is very interesting to note its occurrence i.e. usually occurs in between two limestone (milliolite) horizons. It is a calcium carbonate with impurities of silica, Iron, Magnesia, etc. Chalk is white, dull white, yellowish or grayish white in colour. Chalk is porous in nature and usually contains pebbles of limestone. It contains abundant micro fossils of group of a foraminifera represented by species like rotalids, conchiloquillona, globigerina etc. The specific gravity is 2.7 and hardness is 1-2.5. Chalk occurring in Gujarat is generally of similar composition except the variation of impurities.

- Chalk is used as a fertilizer for whitening and white wash, for crayons, etc.
- Chalk powder is used as a filler in rubber, textile and paper industries.
- Chalk has wide use in the manufacture of cement.

- It is used in agriculture as a neutralizer.
- Pharmaceutical water treatment and fermentation industries also need chalk.
- In addition to all the above uses it finds use as a flux in Iron and Steel manufacture.

There are three chalk pockets in Ranavav Taluka of Porbandar District. The chalk is overlain by pisolitic limestone which laterally at places, grades into milliolitic limestone of pink or cream colours. It is underlain by hard milliolitic limestone of pink or cream colours. It is underlain by hard milliolitic limestone or earthy to grayish green coloured weathered trap. The Adityana pocket has an average thickness of 1.95 mts. The overburden ratio is 1:1.3. The Ranavav pocket is 1.45 mts. thick with an overburden ratio of 1:1.8. The Wadvala pocket covers 2.26 sq.km area with 1.56 mts. thickness and overburden ratio of 1:11. There are three pockets of chalk deposits in Porbandar district of Gujarat State, i.e. Adityana, Ranavav & Wadvala & apart from these the few pockets of Chalk deposits also found in Jamnagar District. Total reserves estimated are 83.79 Million Tonnes. Out of which, 19.24 Million Tonnes in Porbandar, 22.35 Million Tonnes in Jamnagar and 42.20 Million Tonnes in Rajkot.

**China clay** is an important raw material of ceramic industry. It consists of partly crystalline and partly amorphous mineral of Kaoline group. So it can also be called as Kaolinite. Kaolinite is derived from Kaoline which is a corruption of the Chinese kauling meaning high ridge. In short china clay is the deposits of kaoline produced by hydrothermal decomposition or weathering of feldspar. It is relatively a pure clay consisting of predominantly the mineral Kaolinite ( $Al_2O_3 \cdot 2H_2O$ ) and associated with other clay. Minerals like dickite, halloysite, nacrite and anauxite, Kaolin is commercially valued for its whiteness and fine particle size. It often contains small amounts of impurities in the form of rock fragments, hydrous oxides and colloidal materials. In Gujarat crude china clay finds uses mainly in cement industry and of processed china clay in



ceramic industry. Kaolin, both in crude and processed forms are produced in the Gujarat. The chemical composition of china clay is, hydrous aluminium silicate.  $Al_4Si_4O_{10}(OH)_8$  Ordinary china clay occurs as white earthy masses that are easily crushed and soils the finger. The colour is white but sometimes coloured by iron or other stains. It is brittle and often has slippery feel. It has distinguishing feature that it usually emits a clayey odour when breathed upon and becomes plastic when wet. Further it has high resistance to heat. The specific gravity is 2.2 - 2.6 and hardness is 1.0 - 2.5.

The total estimated reserve of China clay in Gujarat is 163 Million Tonnes Out of which, 100.68 Million Tonnes in Kuchchh, 60.00 Million Tonnes in Sabarkantha and 2.15 Million Tonnes in Mehsana.

The future of the China clay based industries seems very fruitful, as Gujarat has a fairly large share of about 25% of total Indian production of sanitary wares and a high demand of Glazed tiles which has become part of modern living. Only Gujarat is the state producing low temperature insulators. Due to rapid electrification and use of these items in telegraph and telephones this branch of industry has attracted attention of entrepreneurs. Ball clay and China clay are clays used for similar purposes but they vary only in plasticity, China clay being less plastic. Ball clay is a highly plastic variety of Kaolin having high binding power, tensile strength and shrinkage ability. It is generally utilised after mixing with non-plastic clay to impart the desired plasticity in pottery, porcelain and refractory materials. It also helps in the preparation of glaze, enamels and for imparting a dense vitrified body.

#### Diatomaceous Earth



A siliceous sediment made up more or less entirely of the microscopic plants called diatoms. It is exceedingly fine grained, incoherent and highly absorbent. It is used in filters, as an absorbent for nitro glycerine and as an ultrafine abrasive. Many materials can be substituted for diatomite. However, the unique properties of diatomite assure its continuing use for many applications. Expanded perlite and silica sand

complete for filtration purpose. Alternate filler materials for diatomite include talc, ground silica soap, ground mica, clay, perlite, vermiculite etc. It can be substituted in the thermal and sound insulation by materials such as varied clays, special bricks, mineral wool expanded perlite and exfoliated vermiculite. The specific gravity of the material is 2.03 while apparent density is 0.38. It shows filterability of 7.5 ml minute and pH value 8.80 indicating its high alkaline character. These general properties are comparable to properties for diatomites described by Searle and Grimshaw (1960). Diatomite comprises the siliceous shell of diatoms which are microscopic unicellular floating aquatic algae. It has a chemical composition similar to opal and hydrous silica.

### Uses

- As a filter aid especially for colloidal or solid solution like fruit juices, oil, antibiotic etc.
- Life saving drugs like tetra cycline and insulin are filtered through diatomite.
- As an absorbent in increasing in preparation of vegetable oil, poly-ethylene and as a flattening agent in paint, plastic, rubber, drugs, toothpaste etc.
- As an abrasive in metal polishing in automobiles and toothpaste.
- As pozzolanic admixtures in cement industries.
- As a coating material in the manufacturing of ammonium nitrate fertilizers.

The diatomite patches observed at the Padva, Marchand village of Gogha taluka district Bhavnagar appear to form a single bed which is locally disconnected. The bed has a thickness of about a metre. It is found to rest unconformably over lateritic material and in turn is conformably overlain by clay beds. The underlying lateritic material represents the Lower Eocene (Supratrappean) clay formation of bentonitic character. The overlying bed is well stratified and is clayey. The diatomite is even directly exposed at places. Lateritic material occurs bordering the Deccan trap lava flows to the West. On the Eastern side there are well exposed younger Gal beds.

### Dolomite



The name dolomite has been given in honour of the French chemist, Dolomieu (1750-1801). Dolomite is an important natural resource used in many industries.

It occurs as a rock and shows valuable composition, being a mixture of lime and magnesia. Dolomite ( $\text{CaCO}_3$ ,  $\text{MgCO}_3$ ) theoretically contains  $\text{CaCO}_3$ : 54.35% and  $\text{MgCO}_3$ : 45.65% or ( $\text{CaO}$ : 30.4%,  $\text{MgO}$ : 2.9%) and  $\text{CO}_2$ : 47.7%. However in nature this exact proportion dolomite is not available. Hence, in commercial parlance, the rock containing 40-45%  $\text{MgCO}_3$  is usually called dolomite. Dolomite is carbonate of calcium and Magnesium  $\text{CaMg}(\text{CO}_3)_2$ . In ordinary dolomite, the proportion of  $\text{CaCO}_3$  to  $\text{MgCO}_3$  is 1:1. However, calcium may substitute for magnesium upto about  $\text{Ca}:\text{Mg}=1:5$  in the magnesium position and Magnesium may substitute for calcium upto about  $\text{Mg}:\text{Ca}=1:20$  in the calcium position. Further in addition to this, dolomite is a double carbonate of calcium and Magnesium and theoretically contains about 21.7% Magnesium and 30.4% lime, the rest in carbon dioxide. Dolomite occurs in gritty and crystalline forms of variable grain size. It is hard and compact. Dolomite is only slightly attacked by cold dilute acids in contrast to calcite but dissolves readily in worm acids. It is infusible before blow pipe and glows brightly. The colour is usually snow white or brownish white. Chocolate brown or tuff to grey varieties is also found.

Dolomite has got application in various fields i.e., refractory, glass, agriculture, building, cement, paint etc. thus there is growing need for the raw material. As well, with development in Science and Technology, other uses of dolomite will be established. Dolomite is used in industries in the powdered form, thus many pulverizing units have come up in the vicinity of mines, which produce the powder of Dolomite (grade/mesh) according to the end use.

**Feldspar** is one of the most abundant-rock-forming minerals in the earth's crust, comprising a complex of varieties. The term Feldspar designates a



group of minerals that have a general similarity in physical and chemical properties. The Feldspars are indeed so much alike in appearance and general properties that they cannot be told apart

megascopically except in especially favourable circumstances. In Gujarat Feldspar is found associated with igneous rocks. In Sabarkantha district the Idor granite masses accompanied by pegmatites with usual coarse grained nature and graphic texture are consisting of mineral constituents, like orthoclase, white or green microcline, Quartz, biotite, tourmaline and fluorite. Feldspars are also found associated with the intrusives in Girnar hills and reported below the Tertiary sediments of North Cambay basin during the course of drilling at a depth of 1540 mts. by O.N.G.C. They also found associated with the pegmatite dykes in Banaskantha district and the rocks of Pre-Cambrian in Panchmahal district.



**Fire clay** is a term used for clays that endure high temperature of 1500° C or more, without any change other than dehydration. In general,

refractory clays are known as fire clays. Fire clays are so called because owing to alloy content of alkali and other fluxes i.e. Iron and Magnesia and become refractory then can be used as fireclays. The aluminous (kaolinised) variety of fire clay is more of refractory nature because it is hard and dense. It is classified as an acidic type of refractory. This is also a hydrous aluminium silicate. The chemical composition of fire clay is highly variable with Silica 40-80%. Alumina 10-40%, Iron oxide 1-5% and loss on ignition 5-14%. In general the higher the alumina content the greater the refractoriness. The high grades of fire clays do not usually contain more than 3% of alkali or over 2% of iron oxide. Fire clay generally composed of minerals such as Kaolin, Hydromica, dickite, and halloysite in varying proportions. The clay is dark gray in colour with good plasticity and free of grit. When it is kept on fire it turns white. A good fire clay has high fusion point and good plasticity. Further the colour of the product is influenced by the state of oxidation of

Iron the state of division of Iron minerals, the firing temperature and degree of vitrification. Shrinkage workability or plasticity, viscosity, castability refractoriness and strength are the properties needed to be tested to determine, the suitability for different uses.

The important deposits of fire clay in Gujarat are associated with Upper Gondwana Sediments in Than, Wankaner and Morbi areas of Surendranagar and Rajkot districts. The clay beds are 1.5 to 3.7 mts. thick and occur below a bed of Sandstone (Dhrangadhra).

The clay is hard, non-slaking. In Mehsana and Sabarkantha district the sedimentary formation of Himmatnagar series contain intercalations of fire clay. In Panchmahal district, an occurrence of 1.2 meter thick fire clay band is associated with Infratrappean sandstones of Rajpura. The fire clay is approximately 400 mtrs in length.



**Fuller's earth**, like bentonite, is also known as 'bleaching clay' because of its inherent bleaching properties. Fuller's earth is non-plastic clay that can be used to remove colour, filter and purify

animal, mineral & vegetable oils and greases. It has great commercial importance like bentonite. Bentonite is a swelling-type clay while fuller's earth is a non-swelling-type clay this is because of the difference in their chemical composition as Bentonite contains sodium, whereas fuller's earth contains calcium. Calcium bentonite, more commonly called fuller's earth, can be converted into sodium bentonite by cation exchange process or acid activation. Fuller's earth consists primarily of hydrous aluminum silicates (clay minerals) of varying composition. Common components are montmorillonite, kaolinite and attapulgite. Small amounts of other minerals may be present in fuller's earth deposits, including calcite, dolomite, and quartz. Fuller's earth is also referred to as calcium bentonite, which is altered volcanic ash composed mostly of montmorillonite.

- Fuller's earth is used to decolourise, deodorise, dehydrate and neutralise various minerals,



vegetable/ animal oils, etc.

- It is also used in the manufacture of No Carbon Required (NCR) papers.
- Fuller's earth is generally used in Fertilizer Industry as a carrier.
- In animal feed, fuller's earth is used as binders for pelletized feeds, carriers of supplement free flowing additives for feed in flour and lubricants to reduce dye friction.
- Fuller's Earth is also used in other unconventional things such as for cleaning oil spillage on factory floors; as carrier for insecticides, fungicides and as a mineral filler & extender.

The total reserves/resources of fuller's earth in India as on 1.4.2015 as per NMI database, based on UNFC system have been estimated at 261.38 million tonnes. Out of these, only 3.94 million tonnes are placed under 'Reserves' category while remaining 257.4 million tonnes (98.49%) are placed under 'Resources' category. About 74% of the total resources are located in Rajasthan. The Remaining resources are in Telangana (10%), Arunachal Pradesh (8%), Assam (7%), and negligible quantity in Karnataka and Madhya Pradesh.



**Graphite** is one of the important industrial mineral. Graphite, is also known as plumbago or black lead, is a variety of naturally occurring carbon. It crystallizes in a lamellar hexagonal system, has grey to black metallic lustre and is greasy to feel. Natural graphite normally contains various impurities. Low grade graphitic material can be upgraded generally by forth flotation process to produce concentrates containing the desired carbon content, to meet the requirements of different industries. Synthetic or artificial graphite is manufactured on a large scale in electric furnaces, using anthracite or petroleum coke as raw feed. Graphite occurs as scales, columnar masses or sometimes as granular masses. It is iron black to dark steel grey in colour with a specific gravity of 2.09 to 2.23. Hardness is 1 to 2. Graphite resembles molybdenite in most of its

physical properties, but, it distinguished by its iet black streak. It is opaque. It is a good conductor of heat and electricity. It is resistant to attack by ordinary chemical agents. It has high melting point (more than 2000°C) and vaporisation points. It is soft, self-lubricating, and has a soapy feel. Graphite generally occurs in rocks of the Champaner series consists mainly of Quartzites, gritty Quartzites, and phyllites, Graphite occurs in graphitic phyllites in the form of bands. In Gujarat, Graphite deposits of commercial importance are found in Panchmahal and Vadodara Districts, over a strike length of about 100 km. Between Devgadbaria and Chhotaudepur. The thickness of the graphitic layers varies from a few centimeters to as much 18 meters. Most of the Gujarat graphite is of amorphous type, some crystalline, flaky bands have also been encountered.



**Gypsum** is widely used in industry because of its special property of losing three fourth of the combined water of crystallisation when moderately heated (Calcining) of about 130°C. Beside, this 'calcined gypsum' when cooled, finely ground and made plastic with water can be spread out, cast or mould to any desired surface or form, and finally can resume its original state or set into a hard rock like form. Raw un-calcined gypsum is used for controlling the setting time of Portland cement (as a retarder to prevent quick set). It is added to-the clinker just before final grinding to finished cement. Ground pure white gypsum is also used as filler in paper, paint and textile goods. Alabaster, a dense massive granular and translucent variety, is employed as ornamental stone in statuary and interior decoration, and selenite, a crystallized clear transparent colour variety, is used in the manufacture of cement or 'sensitive' plate for petrological microscopes. In addition to mineral gypsum, sea water and phosphoric acid plants and important sources of by product gypsum. Marine gypsum is recovered from salt pans during processing of common salt in coastal region. Gypsum is one of the most important of the non-metallic minerals, and its uses date back thousands of years to the days of the Assyrians and Egyptians

who used by the Greeks and Romans for plaster, and the soft variety of alabaster was prized for sculpturing.

### Chemical Composition

It is a hydrated calcium sulphate ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) the proportion of chemically combined water being 20.0%. Generally it occurs in six recognized forms.

- Selenite or crystallised gypsum, is usually colourless and transparent or translucent, and foliated.
- Satinspar - a fibrous form with a silky luster.
- Alabaster - a fine grained massive variety.
- Rock gypsum - the massive form
- Seed gypsum - an aggregation of small loose more or less rounded crystals resembling wheat grains.
- Flour gypsum or gypsite - a very fine grained aggregate of loose grains resembling flour in texture.

### Physical Properties

Pure Gypsum is white, and when in crystalline form, is translucent to transparent. The commercial mineral is often grey, yellow or flesh red, or occasionally pale blue. In crystal form the mineral has a perfect cleavage in to thin flexible plates, and crystal faces have a pearly or vitreous luster. The massive varieties are sometimes glistening, or may have a dull earthy appearance. Gypsum is very soft (hardness 1.5 to 2.5 on the mohs scale) and so is readily distinguished from calcite. The specific gravity is 2.35 i.e. one cubic foot of solid gypsum weights 143.785 lbs). The mineral is soluble in hydrochloric acid, and slightly soluble in water.

This is the name applied to Calcined gypsum, from which three quarters of the water of crystallization has been driven off by gentle heating. Plaster of Paris is a white powder, the chemical composition of which is calcium hemihydrate 2 ( $\text{CaSO}_4$ )  $\text{H}_2\text{O}$ . This powder recombines with water to form a comparatively hard and solid mass which is the useful characteristic of plaster of Paris.

Plaster of Paris is widely used in the building

industry for the manufacture of various types of plaster sheets, wall boards, moulding, cornices, linings, ceilings and wall finishes. In building construction use is also made of the fire resistant properties of plaster in protecting structural steel work. Other uses of plaster of Paris include moulding plaster, surgical applications, dental plasters, for fireproof lining of strong room doors and safes, for mounting museum specimen and many minor applications.

Gypsum occurs in regular beds of lens, horizontal or gently inclined, sometimes in association with rock silt, limestone and shales, varying from a few feet up to several hundred feet in thickness. It also occurs as platy crystals in marine silts, along the sea coasts subject to periodic incursion by sea water. It also forms as lake deposits by the evaporation and sometimes underground seepage of saline water plays important role. In Gujarat-the Gal clay is gypsum bearing clay.

In Gujarat it is also produced as a by-product in salt farms situated in Jamnagar, Kharaghoda, Kandla and Victor area.

In Gujarat Gypsum deposits are very few and with a limited reserve so far explored.

In Bhavnagar district within a 10 miles of radius from the city Bhavnagar it occurs buried under a soil cover. The mineral does not form regular layers or beds but occurs as platy crystals embedded sporadically in Gaj clays, seldom exceeding two to three percent of the entire bulk of clays. The other localities where the gypsiferous clays found are chitra, five kms to the south-west of Bhavnagar, Adhewada, Malanka and Akvada exposed in Maheswari river section. Tagadi and Bhutesar in Stream: the stream bed under an over burden of about 10 to 12 feet.

In Junagadh district small but workable quantities of Gypsum are recorded by Mr. S. Krishnaswamy at localities Balanvav in Gal formation near Panchalaa 4000 feet long and 50 feet wide strip of Gypseous clay with a thickness of 18 inches are found. The other localities are Kadiali, Miyani and Bharwada of the district. The estimated reserves of Junagadh district is 1, 40,000 tonnes.

In Jamnagar district at Ran Selenite veins varying from mere streaks to three inches in thickness and segregations up to one feet six inches long and four inches in thickness and width, are found sporadically in a bluish plastic clay (Gaj), near the junction of Gaj beds and laterites, The clay bed is generally visible in a 372 mile long and one mile wide strip. The clay bed appears to be over 20 feet thick and lies below a 4 feet thick over burden of black soil in the flat portions of the area. The average yield of Gypsum is two tons per 1000 cubic feet of clay. On this basin, about 5, 00,000 tonnes are likely to be present generally within 30-50 feet.

At Virpur selenite veins in a marl bed covering an area of 4 kms by 1 km, the total thickness of the marl bed being over 10 feet, underlying four feet of soil. The veins, platy or fibrous, range from mere streaks to three inches in thickness. On the assumption of about one ton of gypsum per 1000 cubic feet of selenitic marl, here nearly 4,90,000 tonnes of material are visualized.

At Bhatia selenitic strip of marly clay in the neighbourhood of Gaj beds and laterite. Roughly 1, 75,000 tonnes of Gypsum can be anticipated.

The estimated reserves of Jamnagar district is 11, 65,000 tonnes.

**Marble is** a crystalline granular rock composed of calcite grains and have all importance of decorative purpose. Marble is the metamorphic equivalent of limestone and dolomite. The



chemical composition of a perfectly pure marble is that of Calcite (CaO: 56% CO<sub>2</sub>: 44%) but small quantities of magnesia, alumina, iron, and silica are generally present, coming from traces of sand, clay, and dolomite mixed with it. The colour of the marble varied from grey, black, yellow to red. Although the colour may be uniform, it is commonly spotted, patched, clouded, or veined, producing the effect known as marbled. The hardness is that of calcite 3, marble is therefore readily scratched or cut by the knife, a ready means of distinction from Quartz or Sandstone, which may resemble it. The specific gravity is 2.71. As there is no specification

properly but for the different purpose it should have certain characteristics.

- For the purpose of sculpturing it should be fine grained uniformly textured as well as coloured.
- For cutting & polishing marble should have a moderate hardness to cut and polish.
- There should be no mica and very little silica.

Slightly dolomitic varieties are often better than pure calcitic marble. Impure marbles having varying amounts of quartz, mica, tremolite, diopside or other silicates may appear more beautiful because these impurities appear as bands, streaks or speaks which produce designs that are greatly prized. However, these impurities become draw back when marble is required for statues. Most durable varieties are those of nearly pure carbonate rocks. The presence of minerals of varying hardness makes polishing rather difficult. The varieties of marble technically valuable are chiefly distinguished on the basis of colour. Statuary marble is the purest, whitest, and most homogenous kind. Architectural marbles have the most uniform tones of colour, while ornamental marbles are distinguished by striking effects of varied colours.

The total reserves of Marble in Banaskantha and Vadodara districts are estimated 259.60 Million Tonnes. Out of which, 257.90 Million Tonnes in Banaskantha district and rest 1.7 Million Tonnes in Vadodara district.



**Mica** is widely distributed and occurs in igneous, metamorphic and sedimentary regimes. Mica group represents 34 phyllosilicate minerals that exhibits a layered or platy structure. Commercially important mica minerals are muscovite (potash or white mica) and phlogopite (magnesium or amber mica). Granitic pegmatites are the source of muscovite sheet, while phlogopite is found in areas of metamorphosed sedimentary rocks into which pegmatite rich granite rocks have been intruded. It possesses highly perfect basal cleavage due to which it can easily and accurately split into very thin sheets or films of any

specified thickness. It has a unique combination of elasticity, toughness, flexibility and transparency. It possesses resistance to heat and sudden change in temperature and high dielectric strength. It is chemically inert, stable and does not absorb water.

Most important mica-bearing pegmatites occur in Andhra Pradesh, Bihar, Jharkhand, Maharashtra, Odisha, Rajasthan and Telangana. Occurrences of mica pegmatites are also reported from Gujarat, Haryana, Karnataka, Kerala, Tamil Nadu and West Bengal. As per NMI database based on UNFC system, the total reserves/resources of mica in the country as on 1.4.2015 have been estimated at 6,35,302 tonnes out of which 1,14,433 tonnes are placed under Reserves category and 5,20,869 tonnes under Remaining Resources category. Andhra Pradesh leads with 41% share in country's total resources followed by Rajasthan (28%), Odisha (17%), Maharashtra (13%), Bihar (2%) and a small quantity of resources is found in Jharkhand and Telangana.

- Natural sheet mica is used in Electrical and Electronic industries in the form of blocks, splittings and films or built-up mica called "micanite".
- Sheet mica is used in manufacturing fabricated and micanite products, such as, capacitors and commutator segments.
- Other uses of sheet mica include gauge glasses of high pressure steam boilers, diaphragms of oxygen-breathing equipment, marker dials of navigation compasses, quarterwave plates for optical instruments, window covers for radiation pyrometers & thermal regulators, stove window, chimneys for gas & petromax lamps, diaphragms in microwave transmitters and insulation wrappers for high tension radar coils.
- Micanite is used in electrical insulation mainly because natural mica sheet of sufficient thickness is not always available. This is used in copper commutator segments of DC universal motors and generators, moulding plates from which V-rings are cut and stripped for use in commutators. These moulding plates also find

use in the form of tubes and rings as an insulator in transformers, armatures and motor starters.

- Mica is used in insulation bricks, slabs and tiles because of its excellent thermal and insulating properties.



**Ochre** is a natural mineral pigment. In ancient times it had been used in colouring earthenware, house hold utensils and for decorative purposes. It occurs in various shades and

colours generally ranging from yellow to deep orange or brown. The pigmentary strength of ochre is mainly due to the presence of oxides of iron. The presence of hydrated iron oxide imparts yellow colour and anhydrous iron oxide red. A mixture of ferrous and ferric oxide imparts mainly brown besides other shades. Depending upon the colour, the ochres are called red ochre, yellow ochre, green earth, sienna, umber and various other names. Red ochre is mostly used in cement industry. The cement grade mix raw material requires a minimum quantum of iron and alumina. The red ochre mixed with limestone makes a perfect mix of constituents in the raw material fed to the cement manufacturing units. Ochres are non-toxic and are used in manufacturing of paints that not only dries quickly but also covers surfaces thoroughly.

The total reserves/resources of Ochre as on 1.4.2015 as per the NMI data, based on UNFC system, have been estimated at 167.79 million tonnes. Out of these resources, about 36.93 million tonnes are under 'Reserves' category and 130.86 million tonnes are under 'Remaining Resources' category. Of the total, about 87% resources are of red ochre, 11% are of yellow ochre and the remaining 2% are of grades "Not-known". About 78% resources are concentrated in Rajasthan, followed by Madhya Pradesh 11%, Andhra Pradesh 7% and Gujarat about 2%. The remaining 2% resources are located in Karnataka, Maharashtra, Jharkhand and Uttar Pradesh.



**Perlite** is hydrated glass, a volcanic rock chiefly a rhyolite having pearl like lustre, which

has unusual characteristic of expandability when rapidly heated, the rock explodes in manner similar to popcorn. Crude perlite is essentially a metastable amorphous aluminium silicate. It expands about 4 to 20 times its original volume when heated to a temperature of 1400° C. It has low density, low thermal conductivity and high sound absorption. Geological usage of the term "Perlite" is reserved for type of volcanic glass that exhibits concentric onion skin structure containing from 2% to 5% combined water and having a pearly luster. The colour of Perlite is generally grey, blue and red, green, black or blue variety occur. However, composition of various Perlite is fairly consistent.

- Perlite has number of uses but recently it has been experimented and trials conducted in agricultural applications have found that when used as a soil conditioner, and soil enricher, it conditions the soil in all conditions
- In building and construction it is used as an ultra-light weight aggregate in plaster and concretes, loose fill insulation and as a prime ingredient in insulating board and ceiling tiles.
- Perlite is used as filter aid in water treatment and purification,
- In processing of sugar chemical and pharmaceuticals.

Texture paints are being increasingly used as an economical method of concealing surface flaws and irregularities in the joints between dry wall paints. Perlite is replacing sand as the texturing material to an increasing extent. Perlite is not only as effective as sand but displays much less tendency to settle in a paint.

Chemically bonded perlite is used to produce refractory blocks and bricks for insulating back up duty in many of the following installations

- Boilers
- Forging Furnaces
- Heat treating Furnaces
- Annealing Furnaces etc.

Other uses suggested for perlite are as extenders for

grease in soap, fertilizer extender to increase bulk and filler, extender of carrier in many possible applications.

In this way, perlite has wide ranging application and it will serve many useful purposes.

Perlite is metastable, eventually with age, like any glass it will devitrify into micro-crystalline quartz and feldspar. Due to the instability of perlitic glasses, most occurrences are generally of Tertiary or Quaternary age (less than 50 million years old).

Perlite is formed by the hydration of rhyolitic obsidian, a rock which is the result of rapid chilling of molten lava. The volcanic origin of Perlite creates occurrences of Perlite rock as dykes, domes, sills, or flows. Economically, dykes and sills of Perlite are generally too small to be of value. Flows of a hundred feet thick and covering several square miles do occur. Occasionally some domes are thousands of feet across and several hundred feet thick.

Gujarat is the only fortunate State in the country to have perlite deposit of the Osam hills in Rajkot district where black colour perlite is found and the mine is under development. The perlite rock after mining is crushed, dried and screened and blended to particle sizes required for particular uses. The ore is then injected into furnace at a temperature between 870 and 1100°C to produce expanded perlite. The expanded product is chemically inert, has a pH of approximately 7, it is sterile and free of organic impurities. It is non-combustible having a fusion point of 1260-1340°C Expanded perlite can be manufactured between 32 kg/m<sup>3</sup> to 176 kg/m<sup>3</sup> depending upon the application and the product specification.



**Quartzite** is a hard, non-foliated metamorphic rock which was originally pure quartz sandstone. Sandstone is converted into quartzite

through heating and pressure usually related to tectonic compression within orogenic belts. Pure quartzite is usually white to grey, though quartzites often occur in various shades of pink and red due to varying amounts of iron oxide (Fe<sub>2</sub>O<sub>3</sub>). Other

colours, such as yellow, green, blue and orange, are due to other minerals. When sandstone is cemented to quartzite, the individual quartz grains recrystallize along with the former cementing material to form an interlocking mosaic of quartz crystals. Most or all of the original texture and sedimentary structures of the sandstone are erased by the metamorphism.

Because of its hardness and angular shape, crushed quartzite is often used as railway ballast. Quartzite is a decorative stone and may be used to cover walls, as roofing tiles, as flooring, and stair-steps. Its use for countertops in kitchens is expanding rapidly. It is harder and more resistant to stains than granite. Crushed quartzite is sometimes used in road construction. High purity quartzite is used to produce ferrosilicon, industrial silica sand, silicon and silicon carbide. During the Paleolithic, quartzite was used, along with flint, quartz, and other lithic raw materials, for making stone tools.

Quartzite is a granulose metamorphic rock consisting essentially of quartz and sandstone cemented by silica, which has grown in optical continuity around each grain. The occurrences are reported from Andhra Pradesh, Bihar, Delhi, Haryana, Karnataka, Kerala, Madhya Pradesh, Rajasthan, Tamil Nadu, Uttar Pradesh, Gujarat etc.

Current resources of quartzite in India stands at 1251.25 million tonnes, out of which reserves are placed at 86.60 million tonnes and remaining resources at 1,165 million tonnes.



**Sandstone** is a clastic sedimentary rock composed mainly of sand-sized (0.0625 to 2 mm) mineral particles or rock fragments. Most sandstone is composed of quartz or feldspar (both silicates) because they are the most resistant minerals to weathering processes at the Earth's surface. Like uncemented sand, sandstone may be any colour due to impurities within the minerals, but the most common colours are tan, brown, yellow, red, grey, pink, white, and black. Since sandstone beds often form highly visible cliffs and other topographic features, certain colours of sandstone have been strongly identified with certain regions.

The sand may consist of grains of quartz, felspar and other detrital minerals with interstitial cementing material.

Occurrences of sandstone in India are spread across Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Madhya Pradesh, Meghalaya, Mizoram, Karnataka, Odisha, Punjab, Rajasthan, Uttar Pradesh, Tamil Nadu and West Bengal.

In Gujarat, fine to medium-grained sandstone of varying colours ranging from white, light purple, reddish-brown, cream to yellow are found in the district of Kachchh. A brownish yellow sandstone occurs near Chabari and Mainapara in Bhachau. The sandstone in Rampur, Katada-Roha and Rajoda Dungar near Mangwana in Nakhtrana is cream coloured and is fairly hard. Extensive deposits are found around Songir, Naswadi, Ghautoli, Namaria and Lachharas in district Vadodara.

Sandstone is used for domestic construction and housewares.

- It is relatively soft, making it easy to carve. It has been widely used around the world in constructing temples, homes, and other buildings.
- It has also been used for artistic purposes to create ornamental fountains and statues.
- Some sandstones are resistant to weathering, but easy to work. This makes sandstone a common building and paving material including in asphalt concrete.
- Because of the hardness of individual grains, uniformity of grain size and friability of their structure, some types of sandstone are excellent materials from which to make grindstones, for sharpening blades and other implements.



**Silica sand** is produced by crushing sand stone or quartzite of open texture, and washing and grading it to yield requisite grain distribution. Silica flour is produced by crushing grinding and washing the high grade quartz, quartzite rocks or from white silica sand.

The general impurities are iron/aluminium oxides and lime.

Sandstone is a friable and hard. The grain size of the particles is variable. It is friable and mainly brown to grey in colour.

### Specifications

Glass making sand IS: 488-1963. Indian Standard For silica sand used for glass making.

### Grades

- **Special Grade:** Intended for the manufacture of high grade colourless glass. Such as Crystal Glass, tableware and other decorative wares.
- **Grade-1:** Intended for the manufacture of decolourized glassware, such as container ware, lamp ware.
- **Grade-2:** Intended for the manufacture of glassware where slight tint is permissible.
- **Grade-3:** Intended for the manufacture of glasses like sheet glass and some coloured glass like iron sulphur amber glass
- Silica sand used for water purification and manufacture of glass, synthetic foundry, moulding catalysts, di-sodium ultramarine etc. It is also used for acid heat resistant ceramics, refractories, pottery, glaze, enamel etc. Silica sand of 150 mesh is used in Sawing stone, grinding and surfacing glass and polishing marble. Rounded grains of silica sand are used for sand blasting. It is also used as filler in paints 'Wood Paste' moulded hard rubber goods, gypsum plasters, oxychloride acoustic plasters and soap.

- **Geological Setting**

It occurs as loose or poorly consolidated deposits of sedimentary origin or as dunes, blown inland from the coast or as accumulated deposits in estuaries and rivers along the coast sands from these sources shall require a degree of processing depending on their sources and specified foundary requirements.



**Slate** is a fine-grained, very low-to-low metamorphic rock possessing well-developed fissility tendencies that are parallel to the planes of slaty

cleavage. It is formed by the metamorphism of pre-existing clay rocks, such as, claystone, shale or siltstone. The most remarkable feature of this rock is that it has cleavage planes that are well marked which enable it to be split manually or mechanically into relatively thin slabs.

- Slate is a low-cost decorative stone used for exterior and interior decoration of buildings.
- It is significantly used in roofing.
- It is also used as school slate and also as building dimension stone.
- For roofing tiles, the slate stone should be exfoliated easily and should be free from minerals like iron sulphides or carbonates which after a period of time could cause corrosion and staining.

The Aravalli Mountain ranges in Rajasthan and Haryana; rock assemblages under Kadapa System in Andhra Pradesh and Tamil Nadu; and Himalayan region in Northern India are the regions where slate deposits along with other metamorphosed products are abundantly known to be present. The availability of slates has also been reported from Madhya Pradesh, Haryana, Himachal Pradesh, Jharkhand, Andhra Pradesh, Rajasthan, Uttarakhand, Bihar and Gujarat.



**Talc** is a clay mineral composed of hydrated magnesium silicate. Talc in powdered form, often in combination with corn starch, is widely used as baby powder. This

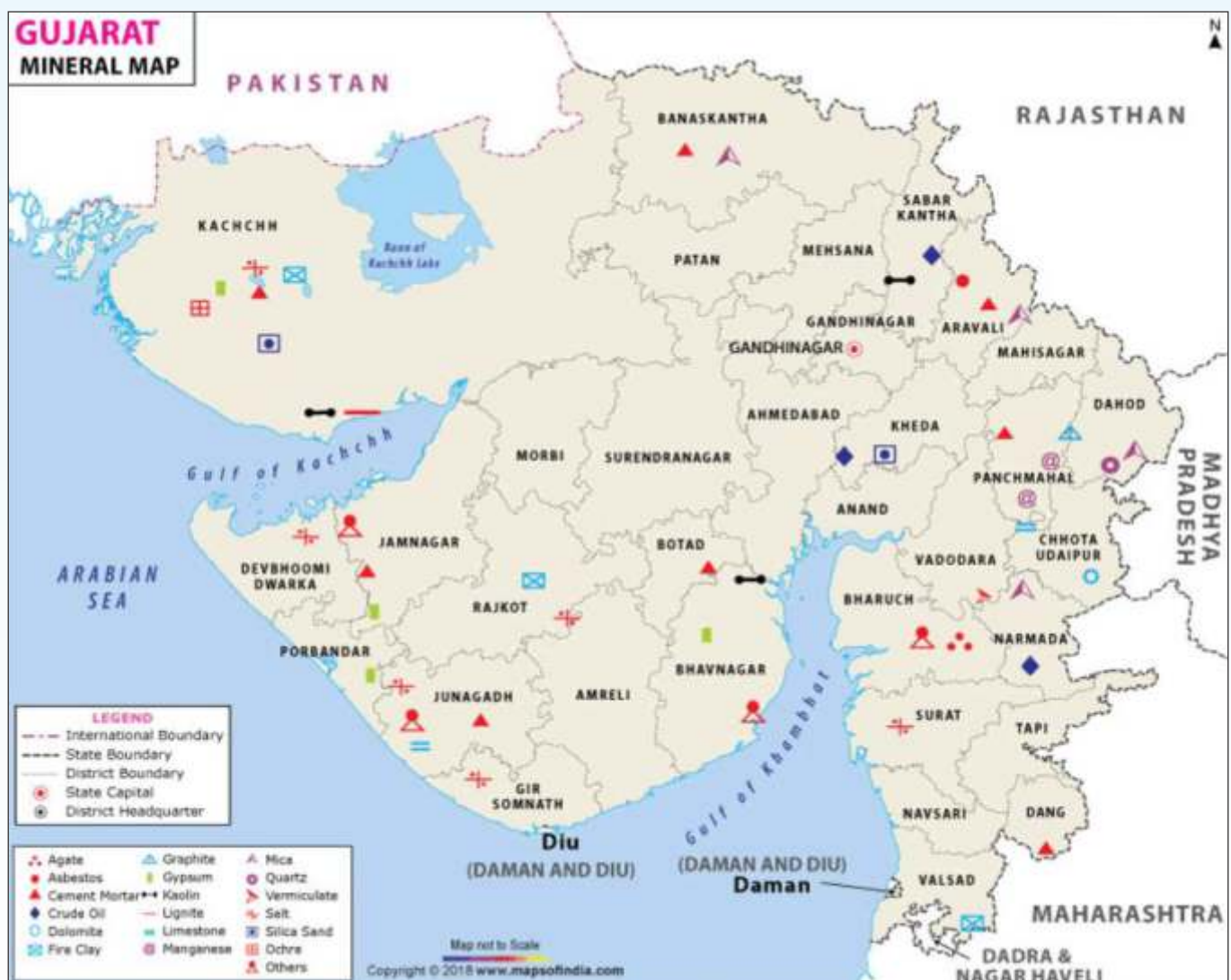
mineral is used as a thickening agent and lubricant, is an ingredient in ceramics, paint and roofing material, and is also one of the main ingredients in many cosmetic products. It occurs as foliated to fibrous masses and in an exceptionally rare crystal

form. It has a perfect basal cleavage, uneven flat fracture and it is foliated with a two dimensional platy form.

- Talc in pulverized form is mostly used as a filler in paper, textile, rubber, insecticides and fertilizer industries.
- Pure talc after calcining, called 'Lava', is used in the manufacture of low-loss ceramic materials essential for radio, radar, television, etc.
- In roofing products, such as tar, paper, asphalt shingles and roll roofing, talc acts as a fire retardant and increases weather resistance.
- Body and face powders (talcum powder) are prepared from the finest quality talc after adding deodorant and perfumes.

The apparent domestic demand for talc was estimated to be 1.35 million tonnes by 2016-17 at 9% growth rate. India is one of the principal sources of 'lava' grade talc suited for specialized purposes like low ceramic materials and of swan shaped talc. Indian talc is considered to be the second best in the world next to Italian talc. The world market conditions for talc minerals are steadily growing, and world talc demand is forecast to increase over the next five years by 2.3% annually. India has large resource base and well-developed production facilities that utilize modern pulverizing techniques.

Source: Compiled from website of Geology and Mining Department





## Reserve of Important Minerals and its location and estimated reserves in Gujarat

Sr. No.	Name of Mineral	Estimated Reserves (In lac Tons)	Place of occurrences
1.	Lime stone	1,19,870	Kutchchh, Junagadh, Porbandar, Amreli, Bhavnagar, Jamnagar, Panchmahals, Sabarkantha, Banaskantha
2.	Bauxite	1,050	Kutchchh, Jamnagar, Junagadh
3.	Lignite	21,390	Kutchchh, Bhavnagar, Surat, Bharuch
4.	Dolomite	7,200	Baroda
5.	Silica Sand	9,835	Kutchchh, Surendranagar, Banaskantha, Bharuch
6.	Base Metal	85	Banaskantha
7.	Chalk	570	Porbandar, Rajkot, Jamnagar
8.	China clay	1,630	Mehsana, Sabarkantha, Kutchchh
9.	Flourspar	116	Baroda
10.	Fire clay	1,552	Surendranagar, Rajkot
11.	Granite	20,050	Amreli, Banaskantha, Mehsana, Sabarkantha, Panchmahals
12.	Manganese	25	Panchmahals, Baroda
13.	Marble	2,596	Banaskantha, Baroda
14.	Wollastonite	30	Banaskantha
15.	Quartz	40	Panchmahals
16.	Bentonite	1,050	Kutchchh, Bhavnagar
17.	Coal	30	Surendranagar, Kutchchh
18.	Gypsum	33	Kutchchh, Jamnagar

## Executed Leases in Gujarat (as on 31-3-2023)

Mining Lease	433
Quarry Lease	4376
Total	7809

## Mineral Revenue during last three years (Rs. In crores)

Year	Major Mineral	Minor Mineral	Others	Total
2019-20	326.01	1031.68	21.81	1379.50
2020-21	236.00	956.00	22.50	1214.50
2021-22	409.96	1256.00	67.51	1733.47
2022-23	545.40	1417.40	70.40	2033.40

## District Mineral Foundation Income from 26-9-2016 to 31-3-2022 (Rs. In Lacs)

Major Mineral	Minor Mineral	Total
72,266	66,474	1,38,740

## ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશન વિજ્ઞાપિત

૧. ગુજરાત રાજ્યના તમામ ખનિજ ખાણધારકો, ખનિજ ઉદ્યોગકારો, ખાણ-ખનિજ સલાહકારો તથા ખાણ ઈજનેર ઈન્ડિયાના, અમદાવાદ ચેપ્ટર નીચે કામ કરતાં સ્થાનિક કેન્દ્રોને જણાવવાનું કે આપના ઉદ્યોગને લગતા નીતિવિષયક, કાયદાવિષયક અથવા આ અંગે કોઈ સૂચનો હોય તો ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશન કાર્યાલય, અમદાવાદ ખાતે ઈ-મેઈલ (gujmin@gmail.com) દ્વારા અથવા પોસ્ટ દ્વારા મોકલી આપવા વિનંતી છે. આ સૂચનોને ખનિજ પત્રિકામાં છાપવા યોગ્ય સલાહકાર મંડળને લાગશે તો 'ખનિજ પત્રિકા'માં પ્રસિદ્ધ કરવામાં આવશે, જેની તમામ વાંચકોએ નોંધ લેવા નમ્ર વિનંતી છે.
૨. 'ખનિજ પત્રિકા'ને આર્થિક રીતે સુદૃઢ બનાવવા માટે સભ્યશ્રીઓને પોતાના ઉદ્યોગ/સંસ્થાની જાહેરખબર આપવા અપીલ છે.
૩. 'ખનિજ પત્રિકા' વાંચી, પોતાના અભિપ્રાય-સૂચનો મોકલવા વિનંતી, જેથી 'ખનિજ પત્રિકા'ને વધુ ઉપયોગી બનાવી શકાય. જિલ્લા કક્ષાએ કાર્યરત મંડળો તેમજ ખાણ કેન્દ્રો પરના ખનિજ ભાવ ત્રિમાસિક મોકલાવે તો ગુજરાતનાં ખનિજ સક્રિય તથા આંતરરાષ્ટ્રીય કક્ષાએ હરીફાઈ કરવા સક્ષમ બનશે.

## 'ખનિજ પત્રિકા'માં જાહેરાતના દર નીચે મુજબ છે

	એક વર્ષ	બે વર્ષ	ત્રણ વર્ષ
આગળનું પાનું	૧૫,૦૦૦	૨૨,૫૦૦	૩૧,૫૦૦
આગળનું અંદરનું પાનું	૧૦,૦૦૦	૧૫,૦૦૦	૨૧,૦૦૦
છેલ્લા પાનાની અંદરનું પાનું	૧૦,૦૦૦	૧૫,૦૦૦	૨૧,૦૦૦
છેલ્લું પાનું	૧૫,૦૦૦	૨૨,૫૦૦	૩૧,૫૦૦
અંદરનું ફૂલ કલર પાનું	૮,૦૦૦	૧૨,૦૦૦	૧૮,૦૦૦
અંદરનું અડધું પાનું	૫,૦૦૦	૮,૦૦૦	૧૨,૦૦૦

## ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશનના સભ્યશ્રીઓને

### વાર્ષિક લવાજમ જમા કરવા

### -: વિનંતીપત્ર :-

જય ભારત સાથે જણાવવાનું કે એસોસિયેશનના સભ્યશ્રીઓને ચાલુ વર્ષ ૨૦૨૩-૨૪ના વાર્ષિક લવાજમના ઈન્વોઈસ મોકલી આપેલ છે. જે અન્વયે એસોસિયેશનના લિમિટેડ કંપનીના સભ્યોએ સભ્યદીઠ વાર્ષિક લવાજમ પેટે રૂ. ૧૦,૦૦૦/- અને લિમિટેડ કંપની સિવાયના સભ્ય પાસેથી દર વર્ષે વાર્ષિક રૂ. ૨૫૦૦/- વર્ષ ૨૦૨૩-૨૪થી લેવાનું ઠરાવેલ છે, જેથી સભ્યશ્રીઓને ચાલુ વર્ષ તથા અગાઉના વર્ષની બાકી રહેલી વાર્ષિક લવાજમની રકમ તાત્કાલિક મોકલી આપવા વિનંતી છે.

## પત્રવ્યવહારનું સરનામું

### સંપર્ક:

સેક્રેટરી, ગુજમિન ઈન્ડસ્ટ્રી એસોસિયેશન, બીજો માળ, માર્બલ એન્ડ મિનરલ ચેમ્બર્સ, ડી. કે. હાઉસ પાછળ  
મીઠાખળી, અમદાવાદ-૩૮૦૦૦૬. ટેલિ.: ૦૭૯-૨૬૪૨૭૦૪૭ ઈ-મેઈલ: gujmin@gmail.com

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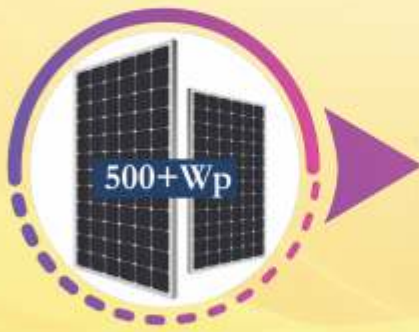
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