

Minerals & Rocks Minerals are naturally occurring, usually crystals with a simple or complex chemical formula. Common examples in our beach pebbles are quartz (SiO₂), potash feldspar (KAlSi₃O₈) and muscovite mica (KAl₂(AlSi₃O₁₀)(OH)₂). Rocks, on the other hand, are mixtures of various minerals. For example, granite is made of the minerals quartz and feldspar, usually grown together with mica or amphibole. Many sandstones also consist of quartz and feldspar but they are fragments broken from other rocks.

Rock Families There are several thousand rock types. Our pebbles are made of only about 30 types, but that's quite enough to be confusing. However, there are only 3 main rock families and it is worth getting to know them.

Igneous rocks are made by cooling and crystallizing hot liquid rock (magma) that comes from deep in the earth. *Volcanic rocks* are poured out as lavas from volcanoes, the magma chilling quickly so there is little time for crystals to form which are big enough to see without a hand-lens or microscope. They include dark basalt and light rhyolite. Other rocks are blasted out as pyroclastic debris ('ash'). *Hypabyssal rocks* are made from magma injected as steep dykes and flat sills into shallow levels of the earth, often in volcano roots. The magma cools less quickly, allowing some bigger crystals to form among the minute ones, giving us the porphyries common among our pebbles. *Plutonic rocks* form from magma injected deeper in the earth, cooling slowly so big crystals of similar size could grow: granite is an example among our pebbles.

Sedimentary rocks are made mainly of fragments of other rocks that were broken up by rivers, wind, waves and glaciers. Those rock and mineral particles were then deposited in the sea, rivers and deserts as sediments that hardened in time to sedimentary rocks, some of which we can see among our pebbles. The particles can be microscopic (mudstone and shale), just visible with the naked eye (sandstone) or a centimetre and bigger (conglomerate with rounded particles, breccia ('brechia') with angular fragments). Most of the modern sediments on the beaches of Ceredigion might eventually be preserved as conglomerate and sandstone. A different type of sedimentary rock is limestone, which is made mainly of calcium carbonate commonly made from fossil shells.

Metamorphic rocks are formed by alteration of other rocks under heat and pressure as they are carried to great depths by plate-tectonic processes, or cooked by injections of igneous rocks. In many of them, the mineral grains are aligned by pressure to give planes of easy splitting; these are cleavage planes in fine-grained rocks and schistosity in coarser ones. In some, light and dark layers were folded by the pressure. Metamorphic rocks made of tiny mineral grains are slate, those with more easily seen crystals (often flakes of shiny mica) are schist, and those with big mineral grains are gneiss ('nice').

Pebble Shapes Pebble-shape may help to narrow down the rock type. Disc-shapes, suitable for 'skimming', are worn by the sea using weak planes such as bedding and mineral alignment. They include many sedimentary and metamorphic rocks. Egg-shaped pebbles are made from rocks and minerals without planes of weakness or alignment, and examples are the Ailsa Craig granite, porphyry, quartz and jasper.

Gneiss ('nice') pebbles are egg-shaped, rather rare, and made mainly of bands of pink feldspar and white quartz alternating with layers rich in dark minerals. This metamorphic rock may have been a sedimentary rock, carried many tens of kilometres deep in the earth's crust. Gneisses are common in northern Scotland, northwest Ireland and Scandinavia, and we can't be certain of the pebble sources.



Gneis. Cerrig ar ffurf wŷ, eithaf prin. Gwnaethpwyd yn bennaf o haenau o ffelsbar pinc a chwarts gwyn am yn ail â haenau'n cynnwys mwynau tywyll. Gallai'r graig fetamorffig yma fod wedi bod yn graig waddod a symudwyd ddegau o gilomedrau yn ddwfn dan ddaear. Mae gneis yn gyffredin yng ngogledd yr Alban, gogledd-orllewin Iwerddon a Sgandinafia, ac ni wyddom ffynhonnell ein cerrig ni.

Vein Breccia Pebbles, egg-shaped or irregular, are grey, with white stripes (veins), and are mostly local. The grey parts are sandstone and shale; the veins are quartz, often with calcite. The veins were made by hot fluids being injected into the grey rock, and the pressure was so intense that the rock was broken into angular fragments (brecciated).



Breccia wythien. Cerrig ar ffurf wŷ neu siâp anghyson, llwyd gyda gwythiennau gwyn, yw'r rhain, o ffynhonnell leol fel rheol. Tywodfaen a siâl yw'r rhan llwyd; chwarts, yn aml gyda chalsit, yw'r gwythiennau. Chwistrelliad o hylifau poeth i mewn i'r graig lwyd sy'n creu'r gwythiennau, o dan bwysedd digon uchel i dorri'r graig yn ddarnau onglol ('brecciated').

Ceredigion Museum, Terrace Road, Aberystwyth, has a collection of pebbles from the local beach. Mae gan Amgueddfa Ceredigion, Ffordd y Môr, Aberystwyth, gasgliad o gerigos o'r traeth lleol.

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Mwynau a Chreigiau Crisialau syml neu gymhleth, o ffynhonnell naturiol, yw mwynau. Ymhlith cerrig ein traethau cewch gwards (SiO₂), ffelsbar potash (KAlSi₃O₈) a mica moscofaidd (KAl₂(AlSi₃O₁₀)(OH)₂). Ar y llaw arall, cymysgedd o wahanol fwynau yw creigiau. Er enghraifft, mae gwenithfaen yn cynnwys y mwynau chwarts a ffelsbar, sydd wedi tyfu ynghyd â mica neu amffibol. Cewch gwards a ffelsbar mewn nifer o dywodfeini hefyd, ond darnau o greigiau eraill ydynt yn yr achos yma.

Teuluoedd y Creigiau Dim ond tua 30 o wahanol fathau o gerrig sydd ar ein traethau, allan o filoedd o wahanol fathau o greigiau. Digon i fod yn ddrystlyd! Mae'n werth dysgu nodweddion y 3 prif ddsbarthiad.

Creigiau Igneaid. Ffurfiwyd y rhain wrth i'r graig hylifol boeth (magma), sy'n dod allan o ddyfnder mawr yn y ddaear, oeri a chrisialu. Mae *creigiau folcanig* yn llifo allan fel lafa o losgfynyddoedd, ac mae'r magma'n oeri'n gyflym fel nad oes amser i grisialau ffurfio mewn maint y gellir ei weld heb ficrosgop neu chwyddwydr. Maent yn cynnwys basalt tywyll a rhyolit golau. Caiff creigiau eraill eu taflu allan fel lludw pyroclastig. Ffurfir *creigiau hypabyssol* allan o fagma sy'n cael ei chwistrellu i mewn i lefelau bäs y ddaear, ar ffurf deiciau serth a siliau llyfn, yn aml wrth wraidd losgfynydd. Yma, mae'r magma'n oeri'n arafach, yn achosi i rai crisialau mwy eu maint ffurfio ymysg y rhai llai, ac yn ffurfio porffyr. Os chwistrellir y magma'n ddyfnach yn y ddaear, ffurfir *creigiau plutonig*. Mae'r magma'n oeri'n araf ac mae crisialau mawr, cyfartal eu maint, yn tyfu; enghraifft o'r teip yma yw gwenithfaen.

Creigiau Gwaddod Darnau o greigiau eraill sy'n ffurfio creigiau gwaddod; darnau a erydwyd gan afonydd, gwynt, tonnau a rhewlifoedd. Gwaddodwyd y gronynnau fel dyddodion yn y môr, afonydd a diffeithdroedd, a thros amser fe'u caledwyd i greu creigiau gwaddod. Gallwn weld enghreifftiau ymysg cerrig y traeth. Gall y gronynnau fod yn ficrosgopig (carreg llaid a siâl), nad yw prin yn weladwy gyda'r llygad noeth (tywodfaen), neu'n gentimedr a mwy. Os hynny, ceir amryfaen os yw'r gronynnau'n grwn, breccia os yn onglol. Yn y dyfodol pell, gallai mwyafrif o'r dyddodion modern ar draethau Ceredigion ddal i fod yma ar ffurf clymfaen a thywodfaen. Math gwahanol o graig gwaddod yw calchfaen, a adeiladwyd yn bennaf o galsiwm carbonad o gregyn ffosil.

Creigiau Metamorffig Creigiau yw'r rhain sydd wedi newid eu strwythur dan wres a phwysedd wrth iddynt gael eu cario i ddyfnedd enfawr gan brosesau platiau-tectoneg, neu eu coginio gan chwistrelliad o greigiau igneaid. Yn aml, bydd pwysedd wedi alinio crisialau'r mwynau i roi craig sy'n hollti'n hawdd; gelwir y rhain yn blannau-holli yn achos creigiau mân crisialog, a sgistedd os yw'r crisialau'n fras. Weithiau, bydd haenau golau a thywyll wedi eu plygu gan y pwysedd. Os bydd crisialau craig fetamorffig yn fân, fe geir llechfaen; os bydd y crisialau'n fwy gweladwy (e.e. mica disglair) fe geir sgist, ac os ydy'r crisialau'n fras, fe geir gneis.

Siapau Cerrig y Traeth Bydd y siâp yn help i adnabod y math o graig. Mae'r môr yn torri i lawr sawl math o greigiau gwaddodol a metamorffig ar hyd eu planau gwan, haenol ac aliniad mwynol, i greu cerrig o siâp disg, addas i'w sglentio ar draws dŵr. Creigiau heb blannau o wendid nac aliniad sy'n cynhyrchu cerrig siâp wy, er enghraifft Gwenithfaen Ailsa Craig, porffyr, chwarts a maen iasbas.

How did the pebbles get here?

Most of the pebbles are made of rocks formed 300 million years or more ago. The pebbles themselves are much younger, less than 1 million years old, broken from old rocks and shaped during and after the Ice Age. In that period, glaciers and streams descended from the Welsh Ice Cap, carrying fragments of Welsh rocks towards Cardigan Bay. In Cardigan Bay a huge south-flowing glacier system, the Irish Sea Ice, brought in fragments from Ireland, Scotland and farther afield. The glaciers and melt waters dumped fragments as moraine, river and other deposits still visible along the coast and inland. As the ice melted, some 14,000 years ago (0.014 million!), the rising sea worked on the fragments, rounding them on the beaches and shaping the pebbles we see today.

Sut y cyrhaeddodd y cerrig y fan yma?

Darnau o graig a ffurfiwyd o leiaf 300 miliwn o flynyddoedd yn ôl yw mwyafrif cerrig y traeth. Mae'r cerrig eu hunain yn llawer iau. Darnau o hen greigiau oeddent, a thua miliwn o flynyddoedd yn ôl y'u ffurfiwyd, yn ystod Oes yr Iâ ac wedi hynny. Yn y cyfnod hwnnw, disgynnodd rhewlifoedd a nentydd o'r Capan Iâ Cymreig, gan gario darnau o greigiau Cymreig tuag at Faes Ceredigion. Ar yr un pryd, ym Mae Ceredigion, roedd system anferth o rewlifoedd, Ia Môr Iwerddon, yn cario darnau o graig i mewn o Iwerddon a'r Alban ac o lefydd pellach. Wrth i'r iâ doddi, dadlwythodd y rhewlifoedd a'r afonydd ddarnau o gerrig fel dyddodion marianol sydd i'w gweld hyd heddiw ar hyd yr arfordir ac ar y tir. Wrth i'r iâ doddi, tua 14,000 flynydd yn ôl (0.014 miliwn!), cododd lefel y môr, ac effaith symudiad y dŵr oedd llyfnhau'r cerrig ar y traethau i'r ffurfiau a welwn heddiw.

Pebble-hunting & presentation Texture and colour are best seen on the surface of wet pebbles, especially through a hand-lens. The 'wet look' can be preserved by coating them with clear varnish, or putting them in a water-filled jam-jar or dish. Breaking them is rarely worth the effort or risk to the eyes.

Casglu ac Arddangos Cerrig y Traeth. Cerrig gwlyb sy'n dangos y lliw a'r ansawdd ar eu gorau, yn enwedig drwy chwyddwydr. Gallwch roi farnais clir ar y cerrig, neu eu cadw mewn dysgl llawn dŵr. Nid yw'n werth eu torri, a gallech wneud niwed i'ch llygaid wrth roi cynnig ami.

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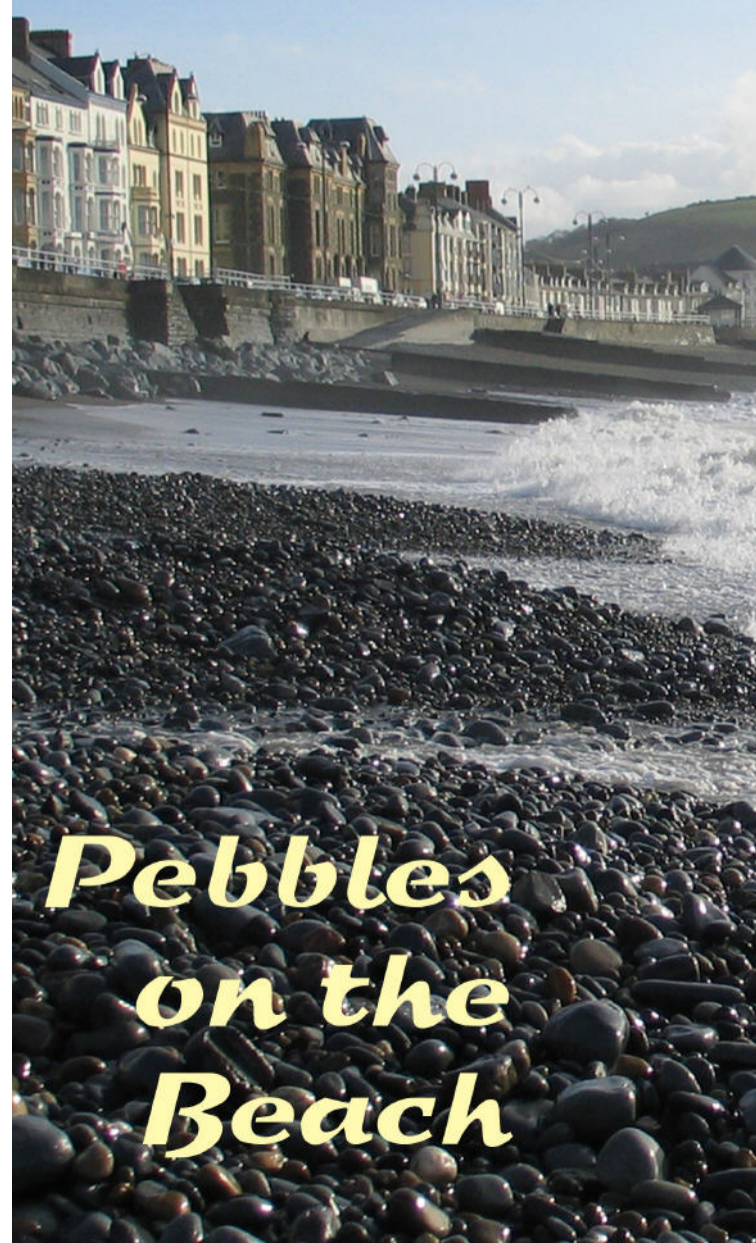


Creigiau Lleol. Mae'r cerrig mwyaf cyffredin ar ein traethau'n llwyd ac ar ffurf disg, gyda rhai o siâp wŷ. Yng Nghei Newydd, ger y ffatri bysgod, ac ambell leoliad arall, maent yn ffurfio meini crwn mawr. Yr haenau neu'r hollti yn y tywodfaen mân gronynnog a charreg laid sy'n cynhyrchu'r siâp gwastad. Ceir hefyd, yn enwedig yng nghyffiniau Cei Newydd, dywodfaen bras a wnaethpwyd o ddarnau onglol o greigiau fel chwarts a ffelsbar. Grutiau Aberystwyth, creigiau gwaddodol o'r Cyfnod Silwraidd (tua 430 miliwn o flynyddoedd yn ôl), yw'r rhan fwyaf o'r clogwyni, ac mae'r môr a'r gwynt wedi bwrw'r rhan fwyaf o gerrig y traeth oddi wrth y clogwyni. Mae'n bosibl dod o hyd i olion o'r ffosil nodweddiadol, Palaeodictyon (ysgrifen hynafol), rhwydweithiau o diwbiau a wnaed gan greaduriaid corff-meddal wrth iddynt dyllu drwy'r gwaddodion meddal. Mwy cyffredin yw gweld amlinelliad o un tiwb. Pethau eraill hynod yw'r cerrig a gerfiwyd o'r nodylau 'côn-mewn-côn', sy'n gyffredin yng Ngrutiau Aberystwyth. Cerrig caled, ar ffurf disg, yw'r rhain, degau o gentimedrau mewn diamedr, gyda nythod o gonau centimedr mewn diamedr yn pwyntio at ganol y nodwl. Er nad oes sicrwydd, meddylir mai adweithiau cemegol yn y gwaddod oedd yn gyfrifol am y nodweddion yma.



Local Rocks The most abundant pebbles are grey, some egg-shaped but mostly disc-shaped and ideal 'skimmers'. At New Quay, near the fish factory and locally elsewhere, they make large rounded boulders. Most of them are fine sandstone and mudstone, with bedding or cleavage that gives the platy shape. Some, especially in the New Quay area, are coarse sandstone made of angular fragments of other rocks, quartz and feldspar. Almost all of them have been battered off the cliffs above the beach by wind and waves, so consist of local sedimentary rocks of the early Silurian Period (about 430 million years ago), the Aberystwyth Grits. Careful searching may turn up the *trace fossil*, Palaeodictyon ('ancient writing'), networks of tubes made by soft-bodied organisms that burrowed along bedding in unconsolidated sediment. Single burrows along and across the bedding are more common. Other curiosities are pebbles carved from 'cone-in-cone' nodules, hard disc-shaped bodies several tens of centimetres in diameter which are common in the Aberystwyth Grits. They are distinctive for the nests of centimetre-diameter cones pointing into the nodule centre. Their origin remains rather mysterious but they probably grew by chemical reactions in the sediment as it was buried.

Cerrig y Traeth



Pebbles on the Beach

Limestone pebbles are egg-shaped and grey; some are bored by modern organisms. Many contain fossils, such as corals, which indicate a shallow, warm marine origin and restrict their age to the early Carboniferous (360-315 million years ago). Such rocks are widespread in North and South Wales, other parts of the British Isles and much of Ireland. However, most or all of this limestone was probably carried here not by glaciers but by 18th and 19th century man to be used to 'sweeten' the soil. Extracted in the Gower and Pembrokeshire, the limestone was brought by sea, to be burned in lime kilns which can still be seen along the coast, for example, at Wallog and Llanrhystud.



Calchfaen. Cerrig llwyd o siâp wÿ; mae gan rai dyllau a wnaed gan organeddau modern. Dengys y ffosiliau fel cwrelau yn rhai o'r cerrig eu bod wedi eu ffurfio mewn moroedd bâs, cynnes. Mae hyn felly'n eu dyddio i Gyfnod Carbonifferaidd cynnar (360 miliwn o flynyddoedd yn ôl). Gwelir y creigiau yma dros ystod eang o Gymru, manau eraill ym Mhrydain a rhan fawr o Iwerddon. Ond y tebygrwyd yw nad rhewlifoedd a gariodd y calchfaen yma, ond dynion y 18fed a'r 19eg ganrif. Roedd ei angen i wella'r pridd. Cariwyd y calchfaen o Fro Gŵyr a Sir Benfro mewn llongau, i'w losgi yn yr odynau calch a welir hyd heddiw ar yr arfordir, er enghraifft yn Wallog a Llanrhystud.

Sandstone pebbles are common, mostly disc-shaped because they are made of beds that are exploited by the sea. Most pebbles are white, yellow or brown, with beds of various colours. Millimetre-sized fragments of glassy quartz and white feldspar are visible in some pebbles, but the grains in most pebbles are too small to see without a lens. Sandstones of this type were deposited at various times in many parts of the British Isles, so it is not possible to identify their source. However, some contain centimetre-sized fragments of coal, fossilised plant material, so probably come from the tropical swamp deposits of the Upper Carboniferous (320-300 million years ago) exposed in North Wales, England and Scotland.



Tywodfaen. Cerrig cyffredin, fel rheol o siâp disg, oherwydd eu gwneuthuriad o welyau a wisgwyd gan y môr. Lliw gwyn, melyn neu frown yw'r mwyafrif, gyda haenau o wahanol liwiau. Gallwch weld darnau maint milimetr o gwards gloyw a ffelsbar gwyn yn rhai o'r cerrig, ond fel arfer mae'r crisialau'n rhy fach i'w gweld heb chwyddwydr. Dyddodwyd tywodfeini o'r math yma ar wahanol amserau dros dir ynysoedd Prydain, felly mae'n amhosibl dweud o ble yn union y daethant. Ond mae rhai yn cynnwys darnau o lo o faint centimetr. Planhigion wedi eu ffosileiddio yw glo, felly mae'n debygol bod y cerrig yma'n dod o ddyddodion corstir trofannol y Cyfnod Carbonifferaidd Uwch (320-300 miliwn o flynyddoedd yn ôl). Mae glo i'w gweld yng Ngogledd Cymru, Lloegr a'r Alban.

Pyroclastic pebbles are rare but distinctive. These volcanic igneous rocks are usually yellow-brown, disc- to egg-shaped, and contain dark centimetre-sized fragments. The fragments are ash that was exploded from a volcano, showering to earth as still hot lumps. Still sticky ones became squashed and welded together under their own weight to make the rock ignimbrite, others remained unwelded. These rocks may show fragments of pink feldspar and glassy quartz crystals, also thrown out by the volcano. There were many explosive volcanoes in Snowdonia and other parts of the British Isles in the Ordovician Period, some 440 million years ago; they may be the source of these pyroclastic rocks.



Cerrig **Pyroclastig** - prin ond neilltuol. Creigiau folcanig yw'r rhain, brown felyn, siâp wÿ neu ddisg, ac yn cynnwys darnau tywyll maint centimetr. Lluw o losgfynydd yw'r darnau yma, a laniodd ar y tir fel lymphiau poeth. Ffurfiwyd y graig ignimbrit gan ddarnau o ludw sydd wedi ei weldio i'w gilydd, ac yna'i wasgu dan ei bwysau ei hun; daliodd eraill heb eu weldio. Efallai y gwelwch greigiau gyda crisialau o ffelsbar pinc a chwarts gloyw a daflwyd allan gan y llosgfynydd. Yn y Cyfnod Ordofigaidd, tua 400 miliwn o flynyddoedd yn ôl, roedd sawl llosgfynydd ffrwydrol yn Eryri a gweddill Prydain; efallai mai dyma oedd ffynhonnell y creigiau pyroclastig yma.

Conglomerate pebbles are abundant and mostly egg-shaped. These sedimentary rocks range from white through yellow to brown, red and purple. Their distinguishing features are the millimetre- to centimetre-sized fragments of rounded quartz and feldspar, sometimes with pieces of sandstone, set in a sandy background. Some probably originated on a beach, and it is easy to imagine shingle on our coast becoming cemented over time to make a closely similar rock. Others may have been deposited in rivers. The reddish colouration comes from iron oxide particles, as found in sediments in some hot deserts and savannahs today. Conglomerates, some of them reddened, were deposited in many parts of the British Isles at various times, for example: the Devonian (Old Red Sandstone)(420 to 360 million years ago); Carboniferous (360 to 300); and Permo-Triassic (New Red Sandstone)(300-200). Permo-Triassic conglomerates may have been exposed in the Irish Sea, close to the modern Cardigan Bay coastline, during the Ice Age.



Amryfaen. Cerrig niferus sydd fel rheol o siâp wÿ. Creigiau gwaddodol ydynt, yn amrywio mewn lliw o wyn a melyn i frown, coch a phorffor. Gallwch eu hadnabod wrth y darnau maint milimetr i gentimetr o gwards crwn a ffelsbar, weithiau gyda thywodfaen, gyda'i gilydd mewn cefndir o dywod. Datblygodd rhai o'r rhain ar draethau, ac mae'n hawdd dychmygu proses debyg yn digwydd dros amser i'r cerrig mân ar yr arfordir. Mewn afonydd y dyddododd eraill. Daw'r lliw cochlyd o ronynnau ocsid haearn, fel y rhai a welir mewn dyddodion yn niffeithiroedd poeth a safanâu heddiw. Ffurfiwyd amryfaen, yn cynnwys rhai cochlyd, mewn sawl ardal o Ynysoedd Prydain mewn gwahanol gyfnodau, er enghraifft: y Defonaid (Tywodfaen Coch Hen) (420 i 360 miliwn o flynyddoedd yn ôl); Carbonifferaidd (360 i 300); a Permo-Triasig (Tywodfaen Coch Newydd)(300-200). Yn ystod Oes yr Iâ gallai amryfeini Permo-Triasig fod yn brigo ym Môr Iwerddon, gerllaw arfordir presennol Bae Ceredigion.

Granite pebbles are abundant. Typically they are egg-shaped and made of pink alkali feldspar, white plagioclase and glassy quartz, speckled by shiny black biotite mica and sometimes dull black amphibole. The minerals are big enough to see with the naked eye. Granite is one of the most common plutonic igneous rocks in the earth's continental crust. It is found in huge masses in various parts of Scotland, NW Ireland and Scandinavia, and much closer to Cardigan Bay in the Lleyn peninsula. Our pebbles could come from any or several of these sources.

Ailsa Craig Microgranite pebbles are common, egg-shaped and easily recognized by their yellow-green background (minute quartz and feldspar crystals) speckled with 1-3 mm blue-grey amphibole, pyroxene and other minerals. Ailsa Craig is a small island in the Clyde estuary 20 km south of Arran, and is the tip of a Tertiary granite intruded 60 million years ago during the opening of the Atlantic Ocean. The island is the only known source of this distinctive rock, so the trail of these pebbles from SW Scotland to Cardigan Bay is used to track the path of Ice Age glaciers flowing south from Scotland. The other claim to fame of this fine-grained granite is that it was quarried to make stones for the sport of curling, although these days the main source is a different kind of granite exposed on the Lleyn peninsula of Wales.



Gwenithfaen. Cerrig niferus, fel rheol o siâp wÿ ac yn cynnwys ffelsbar alcali pinc, plagioclase gwyn a chwarts gloyw, wedi'i fritho gan fica biotit du sgleiniog ac weithiau amffibol du dwl. Gallwch weld y mwynau gyda'r llygad noeth. Gwenithfaen yw un o'r creigiau igneaidd plwtionig mwyaf cyffredin yng nghrawn gyfandirol y ddaear. Gwelir cruglwythi anferth ohono mewn amryw o lefydd yn yr Alban, gogledd-orllewin Iwerddon a Sgandinafia, a hefyd yn Llŷn. Mae'n bosibl i'n cerrig ni fod wedi dod o unrhyw un o'r llefydd yma.

Gwenithfaen-micro Ailsa Craig - cerrig cyffredin, ar ffurf wÿ a hawdd eu hadnabod, gyda'u cefndir melynwrdd (crisialau bychain o gwards a ffelsbar) a smotiau maint 1-3 milimetr o amffibol glaslyd, pyrocsen, a mwynau eraill. Ynys fechan yn aber yr Afon Clud yw Ailsa Craig, 20 cilometr i'r de o Ynys Arran. Pigyn ydyw o wenithfaen Trydyddol Cenosoig a fewnwithiodd 60 miliwn o flynyddoedd yn ôl pan agorwyd Cefnfor yr Iwerydd. Ailsa Craig yw un ffynhonnell y graig neilltuol yma, felly, drwy sylwi ar leoliad y cerrig, gallwn ddarganfod trac rhewlifoedd Oes yr Iâ yn lliw o dde-orllewin yr Alban i Fae Ceredigion. Rheswm arall am ei henwogrwydd yw ei bod yn cael ei defnyddio i wneud cerrig ar gyfer y gamp 'cyrlio'. Erbyn hyn, gwenithfaen gwahanol o Ben Llŷn a gaiff ei defnyddio.

Quartz (SiO_2) is usually a white or cream-coloured egg-shaped pebble. This mineral is the commonest oxide in the earth's crust and is found in many rocks such as granite and sandstone. In Wales, white sheets of quartz often vein the rocks and may carry other, more useful minerals (ores) such as galena (lead sulphide), sphalerite (zinc sulphide), chalcocopyrite (copper-iron sulphide) and, rarely, gold. Many of the rock pebbles contain thin quartz veins.

Flint (SiO_2), like jasper, is an extremely fine-grained variety of quartz. The pebbles are usually knobby-shaped, have a white to orange yellow crust, and are grey to black inside. Flint can be broken (knapped) into thin flakes, which made them extremely useful to our ancestors for manufacturing arrow-heads, spear points and tools. DON'T TRY this at home, however, as the flakes can be razor-sharp and can easily fly into the face and damage eyes. Flint, often in fist-sized lumps, is particularly common in the Chalk of southern England and Northern Ireland. Its origin is uncertain. Some may have formed by hardening of silica gel lying on the seafloor, others deposited in cavities bored by burrowing organisms, yet others may be the result of chemical reactions involving replacement of chalk by silica.

Jasper (SiO_2), like flint, is an extremely fine-grained variety of quartz, which is orangy to purplish red because it contains minute particles of iron oxide. It may be intergrown with white quartz and greenish-yellow epidote, making it one of the most colourful and attractive of the egg-shaped pebbles. Jasper is found in Anglesey and Lleyn, where it fills cavities in 600 million year old basalt lavas of the Mona Complex, which is the most likely source of these pebbles.



Cwarts (SiO_2). Carreg siâp wÿ, o liw gwyn neu hufen. Hwn yw'r ocsid mwyaf cyffredin yng nghrawn y ddaear, ac fe'i ceir mewn creigiau fel gwenithfaen a thywodfaen. Yng Nghymru byddwch yn aml yn gweld gwythiennau gwyn o gwards, weithiau'n cario halwynau mwynol defnyddiol fel galena (syllfid plwm), sffalerit (syllfid sinc), calcopyrit (syllfid copor-haearn) ac, yn fwy prin, aur. Gwelwch wythiennau tenau o gwards mewn llawer o gerrig y traeth.

Flint (SiO_2). Ynghyd â maen iasbas, math o gwards yw fflint, gyda chrisialau mân iawn. Mae'r cerrig fel rheol yn dalpiog, gyda chwrstyn lliw gwyn i oren, a'r tu mewn yn llwyd i ddu. Gellir naddu fflint i wneud pennau saethau a gwaywffyn a hefyd offer, fel y dysgodd ein cyndadau. PEIDIWCH â gwneud hyn gartref, gan fod y darnau'n ffiniog iawn ac yn gallu hedfan i'ch wyneb a'ch llygaid. Mae lymphiau o flint yn gyffredin yng ngharreg galch De Lloegr a Gogledd Iwerddon, ond mae ei ffynhonnell yn ansicr. Mae'n bosibl iddo ffurfio wrth i gel silica galedu ar wely'r môr, neu ddyddodi mewn gwagleoedd a dyllwyd gan greaduriaid, neu fel canlyniad i adweithiau cemegol a amnewidiodd sialc gan silica.

Maen Iasbas (SiO_2). Fel fflint, cwarts gyda chrisialau mân iawn yw maen iasbas, o liw oren i goch-borffor oherwydd y gronynnau bychain o ocsid haearn. Gall fod wedi tyfu ynghyd â chwarts gwyn ac epidot melynwrdd, sy'n ei gwneud yn un o'r prydferthaf o'r cerrig siâp wÿ. Yn Ynys Môn a Phen Llŷn, mae maen iasbas yn llenwi gwagleoedd mewn lafau basalt Cymhleth Mona, 600 miliwn oed, ffynhonnell mwyaf tebygol cerrig ein traethau.

Porphyry pebbles are some of the most abundant igneous rocks. They are egg-shaped and easily recognized by their square, hexagonal and diamond-shaped crystals (phenocrysts) set in rock composed of microscopic crystals. This igneous texture of large and small crystals is termed 'porphyritic' and is commonly found in dykes and sills where the phenocrysts had some time to grow before the rest of the magma chilled to fine crystals. Our porphyries show a range of properties. In some the phenocrysts are glassy quartz (some hexagonal, as seen with a hand-lens), dark shiny biotite mica and pink alkali feldspar. They comprise little or much of the rock, and are set in a background that can be yellow, grey, red or purple (resembling jasper but only in colour). The location of the sources of these porphyries is not known, but such rocks are widely exposed in western Scotland and northern Ireland.



Cerrig Porffyrri. Y rhain efallai yw'r mwyaf niferus o'r creigiau igneaidd. Ar ffurf wÿ, maent yn hawdd eu hadnabod oherwydd eu crisialau sgwâr, hecsagonal a siâp diemwnt (ffencocrystau) o fewn craig o grisialau microsgopig. Yr enw am y cyfuniad yma o grisialau mawr a bach yw 'porffyrig'. Mae'n gyffredin mewn deiciau a siliau oherwydd bod y ffencocrystau wedi cael amser i dyfu cyn i weddill y magma oeri i grisialau mân. Mae'n cerrig porffyrri ni yn amrywio. Gall y ffencocrystau fod o gwards gloyw (siâp hecsagonal, fel y gwelwch drwy chwyddwydr), mica biotit tywyll sgleiniog a ffelsbar alcali pinc. Gosodir hwy mewn cefndir o greigiau melyn, llwyd, coch neu borffor (fel maen iasbas mewn lliw) ac maent yn cynnwys rhan fach neu fawr o'r graig. Ni wn ymhle mae lleoliad ffynonellau'r cerrig porffyrri yma, ond gwyddom am greigiau tebyg yng ngorllewin yr Alban a gogledd Iwerddon.