

Africa. They outcrop very frequently along the axes of mountain chains, flanked on either side by rocks of later age, as in the Urals, Alps, Pyrenees, and Himalayas. Owing to their resistant nature they usually form elevated plateaus, or even mountainous masses. They are in many places repositories of valuable ores, as in Scandinavia, N. America, and Brazil, where they yield iron, silver, gold, copper, nickel, and often precious stones. See Sir Archibald Geikie's *Text-book of Geology*; Dana's *Geology*; Lapworth's *Intermediate Geol.* (1899); *Mem. Geol. Surv. N. W. Highlands of Scotland* (1906); Lawson's *Report on Rainy Lake, Geol. Surv. of Canada* (1887); Adams's *Laurentian System of Eastern Canada*, *Q.J.G.S.*, 64.

Archæology is, as the word itself denotes, the study and discussion of matters relating to antiquity, looking from comparatively recent historical times back to the farthest conceivable limit of the prehistoric ages. By this expression, however, is not to be understood the more remote periods of geology; for, although that science lends its valuable aid to archæology, it is the aim of archæology to confine its inquiries to those geological periods which contain evidence of human and anthropoid life. But within these limits there is, it will be seen, an immense area. And the lines along which archæological study may be followed are many. The most obvious is the line of historical research, and by this method also there is probably the greatest likelihood of attaining to the knowledge of actual facts. No doubt written history is largely mixed with fable, and even its genuine records teem with inaccuracies of varying degree; nevertheless, it is by this medium that the most definite conceptions of archaic life are made

possible. Thus, when two or more historical accounts are collated, such as those of the Jews and the ancient Egyptians or the Assyrians, and when it is found that these histories of diverse nations agree in their description of a certain man, race, or state of society, at a period clearly defined by them, then it is evident that for a moment the darkness of antiquity is dissolved, and an authentic picture is revealed of the actual life of the locality and epoch in question, with possibly the most minute details as to the racial characteristics of the actors in the scene, and their manners, dress, and general surroundings. And when, as sometimes happens, these records are pictorial as well as written, the result is to give the modern mind an impression of that archaic life that is almost absolutely accurate.

But while the only wholly reliable histories are those which have chronicled contemporary events, and described persons or places from the accounts of eye-witnesses, it is not to be forgotten that much of what is accepted as history was not put down in visible characters on stone or parchment until long after the date of the events described. It is quite legitimate to regard this also as history, although under reservation. For in early times, as still among primitive peoples, the chronicles of a nation were orally preserved by special castes of priests or bards, who insisted strongly on the verbal accuracy with which the tribal traditions should be carried on from generation to generation. 'Much passes for history in other lands on far slighter grounds,' observes Sir George Dasent with reference to the Norse Sagas, 'and many a story in Thucydides or Tacitus, or even in Clarendon or Hume, is believed on evidence not one-tenth

part so trustworthy as that which supports the narratives of these Icelandic story-tellers of the 11th century.' More reliance, indeed, ought to be placed on the yet unwritten records of some savage races than on many genealogies which have been in print for generations, but which were deliberately manipulated by the chronicler for the purpose of enhancing the glory of his family or nation. Thus, a certain amount of respect is accorded to the Maori unwritten history, which indicates the beginning of the 11th century as the date of the arrival of that people in New Zealand. At the present day, this oral history can only be noted and no more; but it is quite within the bounds of probability that future research may prove this traditional statement to be scientifically accurate. Accordingly, while it is necessary to proceed with great caution, owing to the manifest uncertainties attaching to beliefs which, in civilized countries, are now only held by uneducated people, the study of popular tradition and folk-lore is becoming more and more a recognized phase of archæology. And this not only means the study of traditional history—of family, tribe, or nation—but also of the many customs and beliefs which still retain their hold upon the minds of the peasantry in civilized lands, and of whole races inhabiting regions as yet little affected by modern ideas. A vast deal of importance clearly attaches to such customs and beliefs; and when, by pursuing the comparative method, it is seen that people of apparently diverse race and history, inhabiting far-separated regions, follow the same practices and hold the same beliefs, it becomes probable that these have descended to them from one common source. It is, of course, necessary to distinguish between the ordinary ideas and

usages which may be justly regarded as natural to humanity, and those ideas and usages which are so specialized that there is little or no probability of their having developed sporadically in different parts of the world. For instance, such a practice as tearing off the scalps of enemies and treasuring them as trophies, once followed in Asia as well as in America, seems to indicate a common origin.

Archæology further derives aid from the study of philology, because, although linguistic affinity does not of necessity denote racial kinship, yet it is plain that nations whose languages belong to one common group must have been at one time politically, if not racially, connected. The testimony of place-names is very distinct. When it is seen, for example, that in Scandinavia, the Hebrides, the Isle of Man, and Iceland, a salmon river is called *laxey*, it is impossible to avoid the deduction that all these places must at one time have been occupied by a Norse-speaking people. That this was indeed the case is, of course, a fact well known in history.

In some respects, the most valuable of all the allies of archæology is the science of anthropology. Written records may disappear; all memories of traditional usage and language may die out; but physical characteristics—stature, the shape of the skull, the colour of the eyes, skin, and hair—all these persist in a race for ages, without any marked alteration. Even when a hybrid race is created by the intermixture of two different stocks, the pedigree of the half-breed people is at once attested by their appearance. And, indeed, it is by the evidences of craniology, by a comparison of the various skulls found in the graves of long-vanished races, that the relative position of those races is sought to be solved.

But the section of archæology which, beyond all others, occupies the minds of many, and is to them archæology itself, is the study of the tangible relics of extinct nations or communities, in the shape of buildings, weapons, and other utensils, and articles used for personal adornment or attire. Architecture forms an interesting subdivision of this section, especially those phases of it which link themselves with hitherto unsolved problems—such as the question as to who were the builders of the mysterious temples and towers of S.E. Africa (Zimbabwe), and the cities and palaces of Central America (Palenque, Copan, Uxmal, etc.), who inscribed the yet unread legends on the stones of Easter I. in the Pacific; who reared the megalithic structures scattered over a great part of the globe; who first designed the rude *brochs* of Scotland, or burrowed out the underground dwellings occasionally unearthed in Europe, and scarcely yet abandoned by the Eskimos of Greenland. All these archaic remains, and many others, offer ample material for archæological investigation. Nor do the manufactured objects found in or near these sites afford less abundant matter for inquiry and discussion. Weapons and other utensils of iron, bronze, stone, horn, bone, and jet; pottery and glass, showing various stages of culture in their makers; articles for personal use or adornment—all have engaged the attention of archæologists, notably in the 19th century. And these relics it is usual to classify and arrange according to their characteristics, separating them into products of the Stone, Bronze, and Iron Periods or Ages.

This classification was introduced by the Danish archæologists Thomsen and Worsaae, during the first half of the 19th century; and their method was soon thereafter adopted in other coun-

tries. The assumption on which the Scandinavian antiquaries proceeded was that mankind has steadily progressed from stage to stage of culture, by an even series of developments, beginning in the condition of the lowest savages. The earliest implements known to man, other than wood, bone, or horn, were of stone (usually flint), very roughly knocked into shape as spear-heads, arrow-heads, knives, hammers, etc. This stage of culture they designated the Early Stone or Palæolithic Age. And, applying their system to Scandinavia, they deduced the following sequence. By a natural process of refinement, a steady and gradual improvement in style and finish resulted in the evolution of the polished and keen-edged implements which superseded their ruder prototypes, and gave the distinctive character to the stage of culture which they designated the Later Stone or Neolithic Age. But by this time the discovery of the use of metals in more southern lands had already led in those regions to an Early Bronze Age, which at length imposed its influence on Scandinavia, and displaced the inferior Neolithic implements. This, again, was followed in succession by a Later Bronze Age, an Early Iron Age, a Middle Iron Age, and a Later Iron Age, the last synchronizing with the Viking Period—*i.e.* from about the beginning of the 8th to the middle of the 11th century of the Christian era. The earliest stage was understood to date back to an indefinite period beyond 3000 B.C. Concurrently with all the later developments, the Stone Age persisted among the Lapp population of the north.

This Scandinavian sequence was adopted, with certain modifications, by Sir John Lubbock in his *Prehistoric Times*. Owing to the fact that implements of the rudest stone type are found

in the river-drift or gravel-drift stratification of Western Europe, 'when man shared the possession of Europe with the mammoth, the cave bear, the woolly-haired rhinoceros, and other extinct animals,' he placed the Drift Men in the Palæolithic Period. The Later Stone Age, or Neolithic Period, he described as the era in which there is no trace of the knowledge of any metal except gold, and when the characteristic implements were of the finely-polished stone or flint already spoken of. Thereafter came the Ages of Bronze and Iron. In France, a similar order was followed by Mortillet and others, but with the added and still more remote Eolithic Period beyond the Palæolithic, and with a much greater elaboration of 'Epochs.' Thus, to take only the Age of Stone, we find the French *savants* dividing the *Période Eolithique* into the *Epoque Thenaysienne* and the *Epoque Ottaienne*, the first named being regarded as the earlier in time. Further, the *Période Paléolithique* is held to progress upwards through the *Epoques Chelléenne, Moustérienne, Solutréenne, Magdalénienne*. All these special names are derived from the places in France where stone implements of various marked characteristics have been found. It may be added that the French classification makes *all* stone implements prehistoric, while bronze and some iron objects are placed in proto-historic times. Iron alone is regarded as the metal of truly historic times—that is to say, in France.

The main idea present in these archæological schemes is extremely reasonable. That primitive races, before learning the use of metals, discovered the advantages of stone implements over those of wood, horn, or bone, is undoubted, and proof of this is everywhere found. Egypt has

had its Stone Age, as the researches of Professor Flinders Petrie and others have shown; while over most of the African continent, as in various other parts of the world, many living races are found who still use implements of stone. Some of these are of rude workmanship, others polished—or, in the recognized diction, they are Palæolithic and Neolithic. Then, again, a Bronze Age is discernible in remote Siberia, evidence of which is seen in the antiquarian museum at Minusinsk, a small town to the south-east of Tomsk. And the advanced races of to-day are living in the Iron or Steel Age.

But it will be noticed that all this presupposes an unusual and incorrect use of the words 'age' and 'period.' The savage races referred to are living in the same age as those who use iron and steel, and it is a misuse of language to say that people of the 20th century are not all living in the same period of time. This misapplication of these words is, however, recognized by modern archæologists, who explain that an archæological 'age' is really a condition of culture, and not a chronological age, and that therefore there may be many concurrent archæological 'ages.' At the same time, it seems more than probable that the originators of these terms employed them in the Lucretian or chronological sense; as, indeed, the French still do. And the generation that succeeded Thomsen found it more and more necessary to give a special interpretation to his nomenclature, as they realized that what applied to Scandinavia did not necessarily apply to other lands. Moreover, a strong party of dissent arose, who protested altogether against the system of successive 'ages.' To a considerable extent the objections thus raised are nullified when it

explained that an 'age' in archæology is not a chronological age. And it ought to be remembered that even Worsaae, who did synchronize his 'ages' with periods of time, regarded the Stone Age as running on in Lapland at the same time as the Bronze and Iron Ages in Southern Scandinavia.

When an implement of stone is discovered, and assigned by archæologists to the Stone Age, it is popularly assumed to be of very ancient date. Yet, in some cases, quite the opposite deduction ought to be made. For instance, when Greenland was reoccupied by Europeans in the early part of the 18th century, the Eskimos were, archæologically speaking, living in the Stone Age, as some of their descendants still are—that is to say, a Stone Age people had succeeded an Iron Age people (the early Scandinavian settlers), and, consequently, the Iron Age relics of Greenland denote a greater antiquity than the implements of the Stone Age. A parallel situation is seen in the temporary overthrow of Roman civilization by savage and semi-barbarous nations. The Huns, who swarmed over Europe in the 5th century, used bone-pointed javelins and dug-out canoes, two indications of Stone Age culture. Yet a Roman sword of even so recent a date as the days of Julius Cæsar would be an article of much greater antiquity. In short, a primitive implement can only be interpreted to denote a primitive race. It may be of 20th century make, or it may be of vast antiquity. All depends upon the history of the country in which it is found, taken in conjunction with the geological stratum in which the object may be embedded.

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Archæopteryx, the most primitive of birds, being a link between reptiles and birds; found as a fossil in the Jurassic rocks at Solnhofen, Bavaria. About the size of a pigeon, it had strong wing and tail feathers, but the neck and bases of the limbs were covered with fine down. The small head, in which, as in modern birds, the bones were firmly united, possessed teeth; the long lizard-like tail had many vertebræ; and at the end of the wing were three long-clawed fingers. The breast-bone shows, by its attachments for strong muscles, that the creature could fly. There are two specimens—viz. in Berlin and the British Museum.

Archangel (Gr. 'chief angel'), a superhuman being above the rank of angel. The archangels are supposed to be seven in number (Rev. 8:2), and the Bible gives us the names of two—Michael (Dan. 10:13; Rev. 12:7) and Gabriel (Dan. 8:16; Luke 1:19). In the apocryphal Book of Tobit (12:15) we find Raphael; while a fourth, Uriel, is mentioned in 2 Esdras 5:20; the remaining three being Chamuel, Jophiel, and Zadkiel. The Jews believed that these names came from the Babylonian. See ANGEL.

Archangel, the (plant) dead-nettle. See LAMIUM.

Archangel (Russ. *Arkhangelsk*). (1.) Gov., the extreme N. prov. of Russia in Europe; area, 330,000 sq. m.; pop. 415,000 (Russians, 86 per cent.), not including Tundra nomads (Samoyedes, etc.). The government includes Novaya Zemlya, and comprises the Arctic coast of European Russia. All the province is either tundra bordering the Arctic Ocean, or forest in the s. part. Rye, barley, oats, and potatoes are raised. The climate presents remarkable differences, the Mûrman coast (Russian Lapland) being as mild as the Baltic. On the shores of

the White Sea, and eastwards to the Kara Sea, as well as in the interior, the winter is extremely rigorous. Fishing, especially of salmon, seal, herring, cod, and flat fish, is important. The forests cover 72 per cent. of the total area. Shipbuilding is active on the Mûrman and on the w. White Sea littoral. Coal, iron, zinc, silver, lead, copper, alabaster, marble, and gypsum are found. There are railways from Vologda to Archangel, and from Perm to Kotlas on the Dwina. A new naval and commercial harbour (ice-free) at Alexandrovsk (or Port Catherine) now supersedes Kola as capital of the Lapland district. See A. P. Engelhardt, in *A Russian Province of the North* (Eng. trans. 1899). (2.) City at the mouth of N. Dwina, and at head of Archangel Bay (65 m. up), chief Russian port on Arctic Ocean; 750 m. N.E. of St. Petersburg; pop. 22,000. Principal exports—wood, cereals, hemp, wax; imports—coal, salt, wine, fruit, cement, machinery. The imports are valued at some £200,000; but the exports (timber alone over £1,000,000) amount to over 11 millions sterling annually. The harbour covers 12 miles of the Dwina bank. A large river traffic descends the Dwina, and a fair is held in September. Archangel was founded in 1584, and was the chief port of Russia until Peter the Great's foundation of St. Petersburg (1703). The town contains two cathedrals (of 1766 and 1805), one an extremely effective specimen of the Russian ecclesiastical style.

Archbishop (Gr. 'chief overseer'), first applied by Athanasius to Alexander, patriarch of Alexandria, and subsequently given to prominent ecclesiastics of the highest rank, some of whom were afterwards styled patriarchs. In the Eastern Church it was given to the exarchs and metropolitans

of certain great sees, such as those of Jerusalem, Antioch, Ephesus, Alexandria, Constantinople, and Rome, the last of whom finally developed into the Pope. In the Western Church the title has been given from the 8th century to metropolitans generally. The title and function of metropolitan was recognized by the Council of Nicæa in 325. By canon law the dignitaries of the Anglican Church are divided into patriarchs, archbishops, metropolitans, and diocesan (suffragan) bishops. In early church times the archbishop had two separate functions: (1) to perform the ordinary episcopal duties of his diocese—symbolized by his bishop's crook; and (2) to supervise the suffragan dioceses as to liturgy, discipline, and conduct of the respective bishops—exemplified by his metropolitan cross, and by the wearing (in the Roman Catholic Church) of the pallium. His special powers included calling together and presiding over provincial synods, enforcing church discipline, and dispensing indulgences. For twelve centuries England has been divided into two archbishoprics—Canterbury and York. The Archbishop of Canterbury, the Primate of *all* England, has as his province (containing twenty-four dioceses) the whole of England except the six northern counties and Cheshire—the province (containing nine dioceses) of the Archbishop of York, or Primate of England. The former is, after the royal princes, the first peer of England, with the right of placing the crown on the sovereign's head at the coronation; the latter has precedence after the Archbishop of Canterbury and the Lord Chancellor, and claims the right of crowning the queen-consort, whose perpetual chaplain he is. In Ireland there are two Anglican archbishops—the archbishop of Ar-

magh and the archbishop of Dublin. Of the Roman Catholic archbishops, there is one in England (Westminster), two in Scotland (St. Andrews and Edinburgh, and Glasgow), and four in Ireland (Armagh, Dublin, Cashel, Tuam). In the British colonies the Church of England has five archbishops—viz. Sydney, who is primate of Australia and Tasmania; Rupertsland, who is primate of all Canada; Montreal; Cape Town; and Jamaica. In the same colonies the Roman Catholic Church has twenty-one archbishops: six in Australasia—Sydney, Adelaide, Brisbane, Hobart, Melbourne, Wellington; eight in America, excluding the United States—Quebec, Halifax, Kingston, Montreal, Ottawa, Toronto, Port of Spain, and St. Boniface; and seven in Asia—Agra, Bombay, Calcutta, Colombo, Cyprus, Madras, and Verapoly. In the United States there are no Protestant archbishops, but there are fourteen Roman Catholic archbishops—Baltimore (the oldest, created in 1808), Oregon City, St. Louis, New Orleans, New York, Cincinnati, Dubuque, San Francisco, Milwaukee, Boston, Philadelphia, Santa Fé, Chicago, and St. Paul. See EPISCOPACY; ARCHES, COURT OF; also Hook's *Archbishops of Canterbury* (12 vols. 1860-76); Raine's *Archbishops of York* (1879); Lightfoot's *Dissertations on the Apostolic Age*, pp. 19, 150, 190 (1892). For the origin and function of metropolitan, see Sohm's *Kirchenrecht*, i. 2 (1892); Loening's *Geschichte des Deutschen Kirchenrechts*, i. 7 (1878).

Archdeacon, an ecclesiastical dignitary in charge of the affairs of a diocese, particularly of its charities, acting as the bishop's assistant in things temporal, as the archpriest in things spiritual, being in reality the 'bishop's eye' and 'right hand.' As the church organization became more settled,

the powers of the archdeacon increased, including separate jurisdiction in the lowest ecclesiastical court, which powers were considerably reduced by the Council of Trent, and entrusted to the bishop's vicar-general. The archdeacons' court (in the Church of England) is now a mere survival. In the Anglican Church there are, in accord with the Act of 1836, from two to four archdeacons to each bishop, there being eighty-five in all; their duties specially including examination of candidates for holy orders, induction of beneficed clergy, parochial visitation, dispensation of charities, care of church fabrics and glebe houses, and holding general synods as deputy of the bishop. See Cripps's *Law Relating to the Church and Clergy* (6th ed. 1896). For the origin of office, see Loening's *Gesch. des Deutschen Kirchenrechts*, i. 2; Cheetham's *History of the Christian Church*, pp. 129 and 176 (1905).

Archduke, ARCHDUCHESS, titles borne by the members of the imperial house of Austria. It began to be used about the middle of the 14th century, but was formally conferred by the Emperor Frederick III. in 1453.

Archegoniata include the moss, fern, and gymnosperm groups of plants, whose common female organ is the archegonium, which is multicellular and flask-shaped, consisting of a hollow body or venter, a tubular neck, and, when ripe, an open mouth. In the moss group the whole organ stands out from the surface of the tissue; in ferns the venter is sunk in this tissue, with the neck exposed; in gymnosperms the mouth alone reaches the surface.

Archegosaurus, a group of fossil amphibians in the Carboniferous and Permian formations, chiefly found in the Rothliegendes (Permian) of Saarbrücken. The skull was pointed, strongly

ossified, with a ring of small (sclerotic) bones round the eyes. The vertebræ consisted of several parts, detached throughout life. The teeth were of the labyrinthodont pattern. The animals resembled gigantic salamanders, with a long body, a long, stout tail, and small, short legs, with a dermal armour of small, bony plates. The group became extinct in Secondary times. See H. N. Hutchinson's *Creatures of Other Days* (1894).

Archelaus. (1.) A Greek philosopher (c. 450 B.C.), born at Athens or at Miletus; studied under Anaxagoras. By observation he inferred for the first time the sphericity of the earth. (2.) King of Macedonia (d. 399 B.C.), natural son of Perdiccas II.; succeeded to the throne in 413. He introduced great reforms in the country, fortifying cities, making roads, and organizing the army. He removed his court from Ægæ to Pella, where he gathered round him the great poets (Euripides, Agathon), painters (Zeuxis), and musicians of the age. He was killed by his favourite, Craterus. (3.) Served as general under Mithridates in Greece, where (86 B.C.) he was twice defeated with great loss, and sued for peace. On the eve of the second Mithridatic war his loyalty was suspected by the king, and he deserted to the Romans. (4.) Son of the preceding, became king of Egypt by marrying Berenice, daughter of Ptolemy Auletes, in 56 B.C., who had obtained the sovereignty of Egypt after the expulsion of her father. At the end of six months he was defeated by the Roman proconsul Gabinius, who had marched into Egypt to restore Ptolemy to his throne. (5.) Son of Herod the Great, was bequeathed (4 B.C.) the kingdom of Judæa. His elder brother Antipas was preferred by the people, but Augustus on appeal decided in favour of Archelaus, and made

him ethnarch of Judæa, Samaria, and Idumæa. Subsequently Augustus banished him, and he died at Vienne in Gaul, A.D. 7.

Archenholz, JOHANN WILHELM VON (1743-1812), German historian, was born near Danzig. He was in England from 1769-79, and in Italy; then went (1792) to Hamburg, and died at his country seat of Oyendorf, close to that city. His *Geschichte des Siebenjährigen Krieges* (1789) has attained great popularity in Germany, owing to the freshness of its style and its admiration for Frederick the Great. He also wrote successful books on England—*England und Italien* (5 vols. 1785); *Annalen der Britischen Geschichte* (20 vols. 1789-98).

Archer, FRED (1857-86), jockey, apprenticed to trainer at age of ten. He won his first Derby in 1877, and was premier jockey for ten years. He committed suicide during an attack of fever.

Archer, JAMES (1822-1904), Scottish painter; studied art in Edinburgh; member R.S.A. (1858). He went to London (1862). He has painted several large subject pictures, including *The Worship of Dionysus*, *St. Agnes—a Christian Martyr*, *Music in the Gloamin'*, etc., but is known chiefly as a portrait painter, his portraits including those of Professor Blackie, Andrew Carnegie, and Sir John Lennock.

Archer, WILLIAM (b. 1856), critic, was born at Perth. He worked on the staff of the *Edinburgh Evening News* (1875-8), with an interval of a year in Australia; settled in London in 1878, and was dramatic critic to the London *Figaro* from 1879-81, and then to *The World* (1884-1905), afterwards to the *Tribune*, now to the *Nation* (1910). In 1900 he paid a visit to the United States, chiefly for the purpose of recording his impressions of the American stage. He has a wide knowledge

of contemporary European drama, particularly the French and Norwegian, and was mainly instrumental in bringing about the performance in London of the plays of Ibsen, whose works he has translated. His criticisms are marked by scholarly insight and a determination to take the drama seriously as an art. Latterly he has also devoted considerable attention to the criticism of contemporary English poetry. His works, besides his translations (1890-2) of Ibsen's plays, and editions of Leigh Hunt's and Hazlitt's dramatic essays, include *English Dramatists of To-day* (1882), *Henry Irving* (1883), *Masks or Faces* (1888), *William Charles Macready* (1890), *Study and Stage* (1899), *America To-day* (1900), *Poets of the Younger Generation* (1901), *Real Conversations* (1904), and (with Granville Barker) *A National Theatre: Scheme and Estimates* (1907). His dramatic criticisms in *The World* from 1893-7 were republished in book form in annual volumes, under the title of *The Theatrical World*.

Archer Fish, a name given to several E. Indian and Polynesian fishes, particularly to the *Toxotidæ* (*Toxotes jaculator*), from their peculiar habit of shooting drops of water a distance of three or four feet, and thus bringing down insects into the water for food.

Archery, the art, practice, or skill of shooting with a bow and arrows. Stone arrow-heads have been found in French caves beside remains of the reindeer and the mammoth. Neolithic arrow-heads and bows are numerous. Among ancient peoples the bow was extensively used by the Scythians, the Egyptians, the Parthians, the Thracians, and, in the time of the Romans, by the Cretans, the Numidians, Balearic Islanders, and other foreign mercenaries. These last did not form a part of the legion, but were skirmishers, like

the Moorish dartmen and the Balearic slingers, their office being to fight here and there, and draw the enemy into action. The Greeks employed archers for the same purpose.

The bow was never greatly valued in Britain until the Saxons began to subdue the inhabitants 'wyth nothyng so much as with their bowe and shafte, whiche wepon beyng straunge.... was wonderfull terrible unto them' (Ascham's *Toxophilus*). The words 'shaft,' 'bow,' 'arrow' are all of Saxon origin, and the Saxon *boga* survives in Welsh as well as in English. But the real interest in archery does not begin until the use of the English longbow, which was encouraged from Edward I. to Charles I., and won at Crécy and Agincourt. The kings of Scotland were not long in imitating the English archery laws, from the days of James I. to those of James V.

Gustavus Adolphus had Lapp bowmen in his army when he invaded Germany in 1630; and Cossack bowmen are said to have formed part of the allied army which took Paris in 1814. The Earl of Essex raised a company of bowmen for the king at the outbreak of the civil war. Many uncivilized peoples have been expert with the bow—*e.g.* the North American Indians. The dwarf Akka of Central Africa are dreaded bowmen, because they use poisoned arrows; as also did the native tribes of the Guianas and the Orinoco region in S. America.

The English archery laws compelled all able-bodied males under a certain rank to practise with the bow on Sundays and holidays, from childhood to the age of sixty; ordered butts to be set up in all villages; commanded sheriffs to provide archery tackle; fixed the quality and the prices of these weapons, and imposed fines to keep the bowyers and

fletchers honest; prohibited nearly all other games; and obliged merchants to import four good bow-staves with every ton of merchandise, and ten with each butt of Malmsey wine, bow-staves six feet six inches long passing free of duty. In the reign of Henry VIII. the use of crossbows and hand-guns was forbidden, as it interfered with the practice of archery; and all archers above the age of twenty-four were commanded not to shoot with their light-flight arrows at a distance under 220 yards, the effective range of the old archery. But at the beginning of the 17th century, when hand firearms began to be more used, the war bow and shaft fell rapidly into disuse.

British archery is still one of the national sports, though a minor one. A tradition of the old martial times is kept alive by the Woodmen of Arden (revived in 1785) and the Royal Scottish Archers, both of which societies shoot for their prizes at the distances fixed by statute when long ranges (exceeding nine score yards) were essential to the success of archery in war. The Royal Scottish Archers, otherwise known as the Royal Company of Archers, date back to 1676. Not the least interesting of their possessions is the famous Flodden bow, the strength of which is estimated at from 80 to 90 lbs. They form the sovereign's bodyguard for Scotland, and on a royal visit they have to present him with a *reddendo* of three barbed arrows. Archery in London is practised by the Royal Toxophilite Society, founded in 1781. See TOXOPHILITE SOCIETY.

See Oman's *Art of War in the Middle Ages* (1898); Ascham's *Toxophilus, or The Schole of Shootinge* (1545; or Arber's edition, 1868); Markham's *Art of Archerie* (1634); Roberts's *English Bowman* (1801); Waring's *Treatise*

on *Archery* (9th ed. 1832); Hansard's *Book of Archery* (1840); Hargrove's *Anecdotes of Archery* (1845); Ford's *Theory and Practice of Archery* (new ed. 1887); and *Archery* in the Badminton Library (1894)—an excellent bibliography is given at the end of this book.

Arches, COURT OF. The court of the Archbishop of Canterbury, established to hear appeals from the various consistorial courts of the province. It is so called because it held its sittings in the church of St. Mary-le-Bow, in the city of London—*Ecclesia Beatae Mariae de Arcubus*. Appeals also lie to it under the Clergy Discipline Act, 1892, and in that case are final; but there is an alternative right of appeal to the Privy Council. The judge, appointed jointly by the archbishops of Canterbury and York under the Public Worship Regulation Act, 1874, is now *ex officio* official principal or dean of the Arches Court and of the Chancery Court of York. See Phillimore's *Ecclesiastical Law*.

Archidamus, the name of five kings of Sparta. The best known are—ARCHIDAMUS II., who reigned 469–427 B.C., and commanded (431–427) the Spartans in the Peloponnesian war—a good soldier, wise in counsel, and of marked moderation in his policy; and ARCHIDAMUS III., who reigned 358–338 B.C., and led an army into Italy.

Archidona, tn., Spain, prov. of and 30 m. N. by E. of Malaga. Pop. 9,000.

Archil, or ORCHIL, a fugitive colouring matter analogous to litmus, obtained from lichens, especially *Rocella tinctoria*, and formerly used in the dyeing of silk and woollen fabrics.

Archilochus OF PAROS, Greek poet, lived probably in the earlier half of the 7th century B.C. He went as a colonist to Thasos, and there lost his shield while fighting against the Thracians. He

returned to Paros, and fell in battle against the Naxians. Of his poetry only fragments survive; but he enjoyed a great reputation in Greece, being classed at the head of satirical poets. Personal satire was his strongest point, but he wrote in many other forms—elegiacs, lyrics, drinking songs, hymns, and poems of reflection. He may be regarded as 'the Greek Swift, but wider than Swift in his range' (Mahaffy, *Hist. of Greek Literature*, 1880). He invented several new metrical forms, particularly the iambic and trochaic, and, according to some, also the elegiac. See CALLINUS. For the fragments, see Bergk's *Poetae Lyrici Graeci*.

Archimage. (1.) The personification of Falsehood in Spenser's *Faërie Queene*, who deceives Una by putting on the disguise of the Red-Cross Knight. (2.) The personification of Indolence in Thomson's *Castle of Indolence* (1748).

Archimandrite, an abbot or superior of a monastery in the Greek Orthodox or Eastern Church, especially one of the first order. Formerly it was used in a wider sense, being sometimes applied to archbishops.

Archimedean Screw, an apparatus invented by the Greek mathematician Archimedes, was first used in Egypt for the purpose of raising water from a lower to a higher level. It consists of a hollow tube in the form of a spiral screw wound round a central axis. When in use the one end is immersed in water, and the whole is set at a slope which must not be greater than a limiting position dependent upon the pitch of the screw; for in order that the water may work gradually upwards from thread to thread, it is necessary that the lowest part of one thread must not be higher than the highest part of the contiguous lower thread. As the Archimedean screw is made to

rotate about its axis, the water in the lowest bend works its way along the screw, and is ultimately expelled at the upper end.

Archimedes (c. 287-212 B.C.), the most famous mathematician of antiquity, intermediate in time between Euclid and Apollonius, was a native of Syracuse. Besides making many important discoveries in mechanics and mathematics, he invented numerous mechanical contrivances. (See ARCHIMEDEAN SCREW.) The machines he made for showering stones on the Roman ships, and for seizing them and raising them in the air, so terrorized the attacking party in the siege of Syracuse that Marcellus at once stopped his assault. He was killed in the confusion attendant upon the capture of Syracuse by the Romans. (See Livy, xxiv.) The extant books of Archimedes are: *On the Equilibrium of Planes, or Centres of Gravity of Planes*; *The Quadrature of the Parabola*; *On the Sphere and Cylinder*; *On Spirals*; *On Conoids and Spheroids*; *On Floating Bodies*; *The Arenarius*; *The Measurement of a Circle*; *Lemmata*. Among the more important editions of his works are those by Torelli (1792), and (in Ger.) Nizze (1825). See Heath's *Works of Archimedes* (1897).

Archipelago. Originally connoting the island-studded Ægean Sea, lying between Greece and Asia Minor, the term has been transferred to any group of islands considered collectively.

Architects, ROYAL INSTITUTE OF BRITISH, founded in London in 1834, incorporated in 1837, re-incorporated in 1887. It confers diplomas (A.R.I.B.A. and F.R.I.B.A.) after examination, and licentiate by election.

Architects, SOCIETY OF, founded in London in 1884, incorporated in 1893. It holds examinations twice a year, in April and October.

Architectural Association of London gives instruction in archi-

itecture; prepares for the examinations of the Royal Institute of British Architects; and generally promotes the association of persons interested in architecture.

Architecture is the art of building according to certain well-defined principles of proportion and symmetry, so that an edifice, when completed, shall not only suit the purpose for which it was erected, in accommodation and usefulness, but at the same time form a harmonious whole, externally and internally. The origin of this art is mainly due to man's necessity for a protection from the various climates of the globe. In prehistoric times there is ample evidence to show that in northern and in tropical climates the inhabitants lived in underground dwellings and caves, in temperate regions in huts (such as the lake dwellings and bee-hive huts), and in warm countries in tents. War also has had a certain influence on the form of architecture, compelling man to construct his dwelling in such a manner and of such material as to be well-nigh invulnerable to the attack of an enemy. But by far the greatest incentive man has experienced in the production of buildings has been through the spiritual sense—*i.e.* the desire or craving to erect a habitation in honour of his God. We find in Britain many remains of such worship, dating from the time of the Druids, Stonehenge being the finest example of this character. In foreign countries magnificent ruins are found of even more ancient date—Egyptian, Indian, Mexican, Grecian, and Roman.

From a description of the architecture of each country and race, it will be seen that the difference in design is largely due to climatic influence, to the warlike and religious feelings of the people, and to the variety and amount of material at their disposal.

PREHISTORIC STRUCTURES. — These embrace the following:—

Monoliths. — Single upright stones—*e.g.* the Carnac stone in Brittany, 63 ft. high, 14 ft. in diameter, and 260 tons in weight. See **MONOLITH** and **MENHIR**.

Cromlech. — Table-stone supported on others that are vertical. Finest example is Kits Coity House, near Maidstone, the table-stone being 12 ft. in length, 9½ ft. in width, 2 ft. thick, and 10½ tons in weight. See **CROMLECH**.

Stone Circles. — The best example is Stonehenge, near Salisbury. The circumference of the circle, which is 300 ft., consisted of numerous uprights, each 18 ft. high, with architrave stones on the top. There are also inside circles of stones, and it is possible that it was entirely roofed over. See **STONE CIRCLES**.

Bee-hive Huts and Picts' Houses. — The first named, so called from their shape, are built of stone, and are found throughout the British Isles; while the latter is a form of underground dwelling of the same period. See **PICTS' HOUSES**.

Lake Dwellings. — Huts of wood, erected on piles above the water-level. Remains have been discovered in Switzerland and elsewhere, through the water in lochs or lakes falling exceptionally low. See **PILE DWELLINGS**.

Cyclopean Architecture. — The name given by the Greeks to the prehistoric forms of masonry supposed to have been erected by the Cyclops or giants. The average blocks of stone were 9 ft. long and 4 ft. thick. These blocks were fitted closely in the walls (25 ft. wide and 60 ft. in height) of the ancient cities of Tiryns and Mycenæ. Similar materials were used at Præneste, Rusellæ, Populonia, and other places in Italy.

Ancient American. — The buildings of Yucatan, in the eastern parts of Mexico, show that that country was at one time peopled

by a race of high intelligence. They used the arch opening, not with radial beds, but corbelled out on each side with stones in horizontal layers. No less than sixty cities have been discovered with temples raised on high mounds and of considerable magnitude, the temple of Palenque being 240 ft. long and 210 ft. wide. The prehistoric remains in Peru are of even more interest. In addition to many tombs circular in plan and widening towards the top, which is covered with a bee-hive roof (not found elsewhere), there are other immense mounds supported by retaining walls, one of these being 828 ft. long, 225 ft. wide, and 108 ft. high. The fortifications at Cuzco consist of three terraces 1,800 ft. long, the retaining walls that uphold them being respectively 25 ft., 18 ft., and 14 ft. in height; and the width between the walls, which are built of solid masonry accurately cut, is 30 ft. and 18 ft. respectively. One stone measures 27 ft. in length by 14 ft. by 12 ft., and many others are about the same size.

ASSYRIAN ARCHITECTURE includes Babylonian and Chaldæan. The building material used was composed of two classes of brick, the inside walls being built of sun-dried bricks, while the outside faces were constructed of the class known as kiln-burnt bricks. The peculiarity of those buildings is their rectangular shape, while their length is out of all proportion to their breadth. The designs employed prove that this was the origin of Grecian architecture. One of the bas-reliefs represents a small temple having two columns on bases, and a form of Ionic capital between two plain pilasters; another shows a palace with windows divided by Ionic columns; while we find some designs of columns with Corinthian capitals, and entablature on the top composed of architrave, frieze,

and cornice, though not in the perfect proportion of the Grecian order.

Until recent times the enormous mounds which represent the ruins of Babylon, etc., were not considered the work of man; but excavations have unearthed brick walls, in some cases 38 ft. thick. Hitherto the most interesting building brought to light is the temple of Birs Nimrud, said to have been reconstructed by Nebuchadnezzar. It was built in diminishing stages towards the top, and was of enormous extent, for at the present time the heap of débris is 200 ft. high and 2,286 ft. in circumference. Above this a portion of brickwork is visible, 28 ft. square and 37 ft. high. Alabaster slabs (19½ ft. by 12 ft.), beautifully carved, and evidently used as a pavement, have been discovered, showing that the interiors of those palaces were magnificent. Carved figures of huge proportion, representing bulls with human heads and winged, stood in pairs on either side of the doorways, while numerous remnants of tiles and coloured plaster work have also been brought to light.

EGYPTIAN ARCHITECTURE. — Among the oldest monuments are the pyramids at Ghizeh, north of Memphis (Cheops, Chephren, and Mycerinus), formed of solid masses of masonry, the sides being stepped from four to five feet on each course. The great pyramid of Cheops, called after the king of that name, has a base of 768 ft. square, and a height of 456 (originally about 490) ft. The sides face the cardinal points, and the stones used are in no case less than 30 ft. long. They were quarried in the Arabian desert, and conveyed by the Nile, and by a specially-constructed roadway 60 ft. wide, to the site. Twenty years were spent in building; and if a similar structure were erected

to-day, the cost would be at least £9,000,000. In all the pyramids the entrance is from the north, and by means of a long passage, inclining downwards and then upwards to the centre, which consists of the sarcophagus chamber.

The Great Sphinx at Ghizeh is another monument to the genius and ambition of the Egyptians. It has the body of a lion crouching, with the head of a man. The length is 146 ft., breadth 34 ft., and height to the top of head 100 ft. (from chin to crown alone is 28 ft.). With the exception of the front paws and a small temple resting between, this monument is carved out of the solid rock.

Temples.—The building of temples was begun long before the dawn of the historic era, and was continued till the time of the Cæsars. The temples were of two types, the one excavated out of the solid rock, and the other built in the ordinary manner. Of the former, Abu-Simbel in Nubia (1400 B.C.) is the finest example. The façade was cut in the perpendicular face of the rock, the entrance having gigantic figures, 66 ft. high, on either side. The interior consisted of a great hall, supported by two rows of detached piers, with immense statues in front of each. In some temples the walls were lined with marble. The plan of an Egyptian temple, when built of masonry, was always uniform, symmetrical, and rectangular, the principal feature being the number of columns. These columns were necessary owing to the roof being built of stone, because of the scarcity of timber. The temple of Edfu, near Thebes, is a typical example (450 ft. long by 140 ft. wide). At one end is the entrance, 20 ft. wide, between two buildings pyramidal in form, which project beyond the sides of the temple, 100 ft. by 35 ft. This leads to a quadrangle 140 ft. by 120 ft., flanked by columns a



Architecture—I.

1. Temple at Edfu, Egypt. 2. The Parthenon, Athens. 3. The Pantheon, Rome.
4. St. Mark's, Venice.

few feet from the main walls, and is supposed to have had a flat roof. At the farther end, opposite the entrance, is a portico extending the full width of the quadrangle, and 45 ft. in depth, the roof being supported on three rows of columns. In the centre of the inner vestibule we find a cell or apartment, surrounded by rooms of various sizes, where the priests lived.

The carving on Egyptian monuments, where they are not plain or covered with hieroglyphics, is peculiar, representing a bundle of trees or reeds bound together by a rope at regular intervals. The capitals exhibit a great variety of form. The entablature is very little subdivided, and what might be termed the cornice consists of a projecting concave member without mouldings, but highly sculptured. The architrave is often covered with patterns representing an orb with a large and small wing and bird's head on either side, the lotus flower or water lily, and palm leaves.

PERSIAN ARCHITECTURE.—As ancient Persia possessed a plentiful supply of timber, the people were induced to erect their dwellings, temples, and palaces mostly, if not entirely, of wood; hence few historical remains are left. There are, however, several exceptions, the most notable of which is perhaps Persepolis, the ancient capital, commenced fifty years after the empire was founded by King Cyrus, whose tomb, situated at Murgab, 40 m. N.E. of Shiraz in Persia, is still in a wonderful state of preservation. The city proper has disappeared, but there still remain the ruins of a portion of the palace called Chehil Minare. This consists of a raised platform from 14 to 40 ft. high, supported by retaining walls 1,424 ft. long on the west and 926 ft. on the north, composed of immense stones, and approached by the finest double

staircase in the world, the steps being 22 ft. long, with a rise of 4 in., and 14 in. on the tread. At the top two large entrance gateways still stand, though there was originally a third. The centre portal measures 39 ft., while the side one is 28 ft. in height. This was the main entrance to the grand hall, the columns of which, still standing, are 60 ft. in height. It is supposed that the remaining portions of the building, including the roof, were completed in richly carved and gilt woodwork. The entablatures are very similar in many ways to the Egyptian, but of more refined design, while the columns exhibit proportions unrivalled in the history of art. The only form resembling Assyrian architecture is the massive sculpture of winged bulls with human heads.

MORESQUE, SARACENIC, or ARABIAN ARCHITECTURE.—See **SARACENIC ARCHITECTURE.**

JEWISH ARCHITECTURE.—Of the buildings constructed by the Jews no ruins remain. The temple was built in the time of Solomon, and was largely composed of cedar wood. The design, which was carried out by Phoenician workmen (the Israelites were untrained in the method of cutting wood), is supposed, from Biblical writings, to have been similar to an Egyptian temple, and probably due to the then world-wide Phoenician enterprise.

CHINESE ARCHITECTURE.—The Chinese style of architecture is based on the principle of the tent. Owing to the peculiar customs, laws, and traditions of the country, each individual is obliged to have a house suitable in size and form to his rank in society. The dwellings are composed of bamboo and bricks, their peculiarity being that after the bamboo framework is put together the roof is erected, leaving the remainder of the building to be filled in. The roof is the

feature of the Chinese style, and has wide projecting eaves turned upwards on the outside. Chinese pagodas are octagonal towers 40 ft. in diameter, having seven to nine stories, 200 ft. high, with a small staircase to the top. The walls are composed of marble or brick, and have many niches filled with idols, while the whole place is lighted by means of numerous small windows. A projecting roof, with corners turned up, and hung with bells, encircles each story, while the top is raised to a considerable height, terminating in a finial. With the exception of the wall of China, triumphal arches, and bridges, we find little stonework used.

INDIAN ARCHITECTURE. — See special article.

GRECIAN ARCHITECTURE. — The Greeks may be justly called the most perfect masters of the art. In proportion and symmetry of design they have never been surpassed, and although they had no knowledge of the principles of the arch, yet their architecture, which was entirely of the columnar order, exhibits a massiveness and quiet repose lacking in the buildings of any other nation. There is a resemblance in some points between their architecture and that of Assyria. To the casual observer the columns, capitals, bases, and mouldings in Grecian art appear similar to those of Rome; but on closer observation it will be noticed that, while the Roman mouldings are formed with the curves of a circle, those of Greece are produced in the curve of a conic section. The proportion of the different members is also dissimilar. The artistic genius of the Greeks enabled them to perceive those defects in a building which are due, not to its actual construction, but to optical illusion. The sides of a column, though straight, may appear hollow: this was rectified by giving

a slight outward curve. And, again, a cornice with top pediment may seem depressed: this defect they obviated by making the highest point in the centre, the entablature being slightly curved. We are also indebted to the Greeks for the pediment design.

It is supposed that Grecian temples and buildings were originally made of wood, and this accounts largely for the various forms found in their stone architecture. The architrave represented the beam on the top of the columns, which again supported the main rafters; the triglyphs represented the external ends of the same; while the slope of the roof rafters necessitated the filling in of the ends of the building by what is known as the pediment. The three distinct orders of Grecian architecture, Doric, Ionic, and Corinthian, are given under CLASSIC ORDERS (see below), showing the different proportions of column, entablature, and mouldings between those of Greece and Rome. Comparing the temples with those of Egypt, we find the centre cell similar in both cases, yet in every other respect they are different. The Egyptians sacrificed external effect, in the endeavour to procure a building with a fine interior; but the Greeks did exactly the reverse. Owing to their main building being formed of stone walls without any moulding, the grace and beauty of the structure depended entirely on the surrounding columnar arrangement.

Our knowledge of Grecian architecture is derived entirely from the ruins of the ancient temples, for there are no traces left of private dwellings. Among the most prominent and ancient ruins of the Doric order we may mention the temple of Jupiter at Ægina, the façade of which is hexastyle peripteral (B.C. 600). The principal ruins in Athens are the Propylæum (437 B.C.) and the Parthenon,

finished in 438 B.C. Both belong to the Doric order, which was the favourite ornamental order adopted in Greece. The Athenian buildings were built of white marble, and it is supposed that, both externally and internally, they were painted in many bright colours, in conjunction with a considerable amount of gilding. In Athens the three principal Ionic ruins are the temples of Ilissus, Minerva Polias, and Erechtheum; while, of the Corinthian order, the Tower of the Winds and the Choragic Monument are the finest examples. There is, besides, an additional order, called the Caryatic order, in which the statues of women were used instead of columns.

ROMAN ARCHITECTURE.—If the Greeks were indebted to Assyria and Egypt for the origin of their designs in building, it is equally true, to a much greater extent even, that the Romans almost entirely borrowed their ideas from the Greeks. Until the conquest of Greece by the Romans in 145 B.C., the buildings of the latter were of the rudest description. The warlike Romans had no time to pursue the arts, but left those peaceful occupations in the hands of Grecian workmen. At the beginning of the Christian era the introduction of buildings circular in plan, the knowledge of the principles of the arch, and the combination of both forming the dome, had the wonderful effect of planting edifices of imposing beauty and grandeur throughout the vanquished countries. The Romans, being more practical and less æsthetic than the Greeks, introduced the segments of circles instead of adopting Grecian mouldings; while, as engineers, their aqueducts, roads, sewers, and bridges were of the most substantial and perfect description. When the nation became less warlike, and settled on more peaceful times, the artistic sense of the people

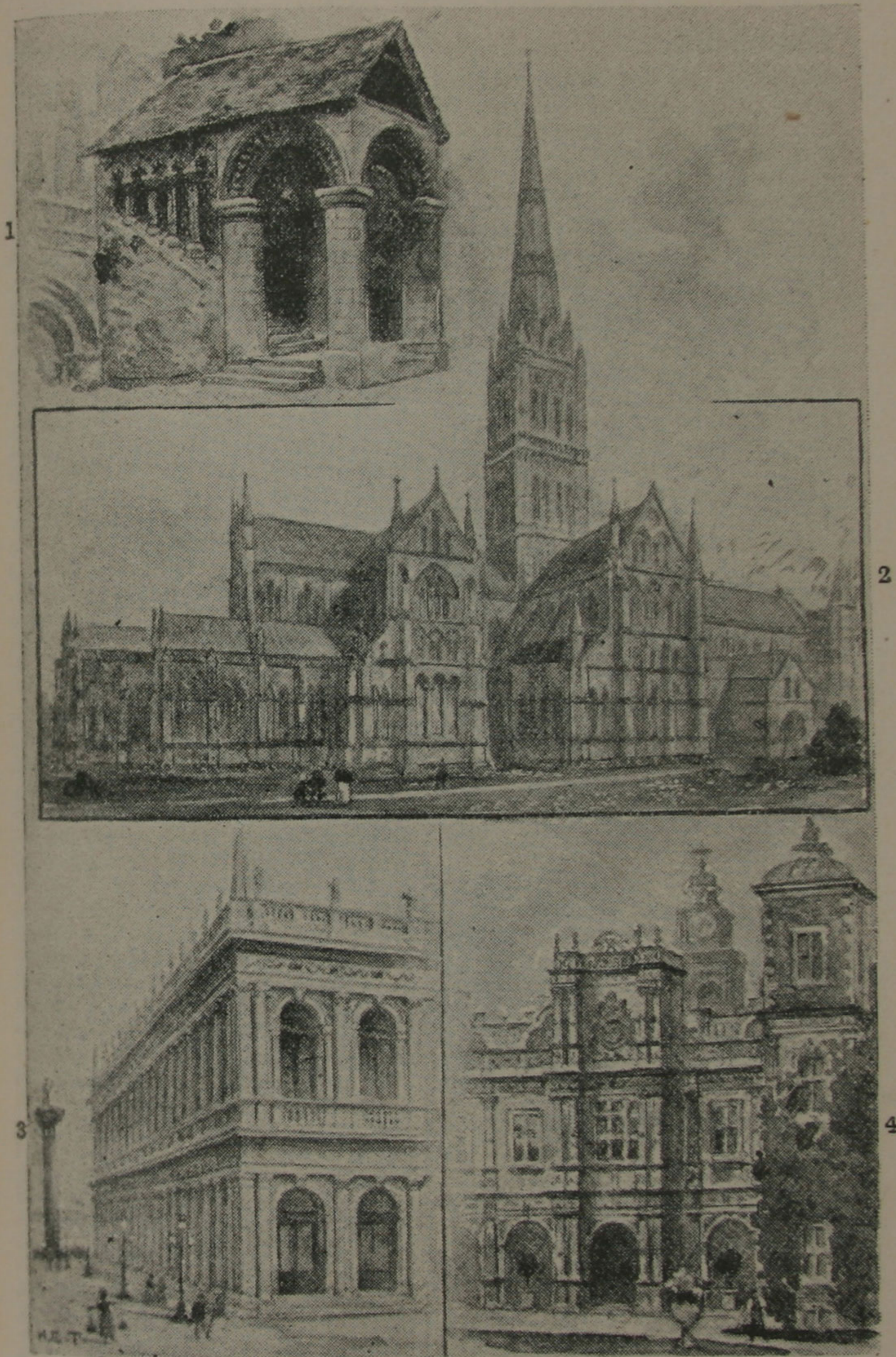
increased; but, unhappily, the advance was checked by the downfall of the empire at a moment of exceptional promise. The orders of Roman architecture (Corinthian, Doric, Ionic, and Composite) are given under **CLASSIC ORDERS** below. Although the Greeks favoured the Doric, the Romans preferred the Corinthian.

Rectangular Temples (Corinthian Order).—The temple of Jupiter (now known as that of Castor and Pollux), situated in the Forum, Rome, is octastyle peripteral in plan, with 11 columns on either side, while the cell is 8 columns in length. When completed, it must have been a building of most perfect form and proportion. The temple of Saturn, or Vespasian, at the foot of the Capitol, Rome, was hexastyle peripteral in plan (extreme size, 115 ft. long and 92 ft. wide); but only the columns remain. It is not so refined and perfect in design as the temple of Jupiter, the cornice being weak.

Ionic Order.—Of this order only two examples are found in Rome—the temples of Fortuna Virilis and Concord. Both are weak in design, with an excessive amount of ornament.

Of the *Doric Order*, the temple of Cora is but a poor imitation of the Grecian, Roman mouldings being adopted in place of Greek. The last two orders, although found in Roman architecture, can scarcely be classified as such, being simply weak imitations.

Circular Temples.—This class is purely Roman. Among the finest specimens stands the Pantheon at Rome, begun 27 B.C. It is circular in plan; inside diameter 139 ft., and columns 33 ft. high. At a height of 75 ft. from the ground is the dome, with five horizontal ranks of panels, the top having a circular opening 27 ft. in diameter. The portico was probably built by Marcus Aurelius Antoninus, 166 A.D., while the interior was com-



Architecture—II.

1. Gateway at Canterbury. 2. Salisbury Cathedral. 3. Library of St. Mark's, Venice.
 4. Hatfield House.

pleted by the introduction of columns by Septimius Severus, 202 A.D. The whole design belongs to the Corinthian order. The temple of Vesta at Rome and that of the Sibyl at Tivoli are of greater antiquity. The cells in each case are encircled by a colonnade of the Corinthian order.

Forums.—All large cities contained several of these buildings. They consisted of a large rectangular court surrounded by a colonnade or aræostyle portico (with ambulatory above), through which entrances led to temples, law courts, theatres, etc. The finest specimen known is that at Pompeii. The forum of Trajan, Rome, is perhaps the largest (1,150 ft. long and 470 ft. broad). At one end was placed the celebrated column of Trajan (115 ft. high), and at the other a triumphal arch.

Triumphal Arches.—In Rome we find those built in honour of Titus, Severus, and Constantine. In earlier times they represented a single arch, but latterly consisted of a large central arch flanked by two smaller ones, and excessively decorated. See ARCH, TRIUMPHAL.

Villas.—The private dwellings of the Romans, although built externally of plain brick, surpass those of any other nation in internal magnificence. Hadrian's villa at Tivoli, and the palace of Diocletian at Spalato, are the finest examples. These houses are generally of one story, with the atrium, or entrance-hall, in front, and behind it an interior court surrounded by a colonnade, off which opened the various apartments, from 10 to 12 ft. square. The ceilings were lofty, and usually formed of stone slabs supported on arched ribs (of stone). The apartments round the atrium were reserved for guests. In many of the villas facing a thoroughfare the frontage next the street was laid out in shops, in a manner very

similar to that of some continental towns at the present day.

Amphitheatres.—These are also of Roman design, ruins existing in most countries conquered by the Romans. The most important is the Coliseum, Rome, built by Vespasian and Titus. Elliptical in shape, it has a length of 615 ft. and a breadth of 510 ft., or about $6\frac{1}{2}$ ac. in area. The arena, 281 ft. by 176 ft., was encircled by a high wall with a parapet, behind which seats rose in tiers to the outside wall. This wall was divided externally into three stories of columns and arches, and on the top was yet another wall, divided by Corinthian pilasters, which were really the upward continuation of the columns below. The whole was surmounted by a frieze and cornice, and the total height from base to summit was 162 ft. This vast building could accommodate 87,000 spectators. See AMPHITHEATRE.

Baths.—It is said that there were at one time as many as 850 baths in the city of Rome, the largest being those of Diocletian, Titus, and Caracalla. That the baths of the last-named were of enormous size is shown by their length of 1,840 ft. and breadth of 1,476 ft. At each end, and at the sides, were temples, while the main building contained a large vestibule, with four halls (on each side) for cold, tepid, warm, and steam baths. In the centre was an immense quadrangle for taking exercise, and, beyond, a hall with 1,600 seats for bathers, while at each end were libraries. In addition there were music, lecture, and dressing rooms, besides gymnasia and swimming baths, all conceived in the highest ideal of Roman architecture, and gorgeously decorated.

Basilicas.—These were the halls of justice, usually attached to the forum. In earlier times they were open in the centre, the only covered portion being the colon-

nade. In later times the walls were raised and roofed in, the part above the colonnade being used as a gallery—one end semicircular in shape—where the judges sat. In many respects these buildings have become models for modern Christian churches. See **BASILICA**.

CLASSIC ORDERS.—In distinguishing between Greek and Roman orders, in addition to the curves of the mouldings being different, there is the variation in the proportion of the diameter of the columns, not only to their height and to the distance they are apart, but also to the depth of the entablature. This is again divided by varying proportions into architrave, frieze, and cornice.

Grecian Doric Order.—Universally used in Greek temples, and consisting of three parts—stylobate, column, and entablature. At the base the stylobate is from two-thirds to one diameter of the column in height, and is divided into equal courses or steps. Resting on the top step is the column, 4 to 6 diameters in height, and diminishing in a slightly-curved line to the necking or hypotrachelium, where it is between two-thirds and four-fifths diameter at base. It is generally divided into 20 flutes. The capital, which is included in the height of the column, is slightly less than half a diameter, and is divided into the necking (one-fifth), echinus or ovolo (two-fifths), and the abacus (two-fifths of the height). The entablature varies from $1\frac{1}{2}$ diameters to 2 diameters, and is divided into architrave (two-fifths), either absolutely plain or divided into three projecting horizontal fillets; frieze (two-fifths), divided horizontally into triglyphs, usually half a diameter in width; metopes (equal in length to the height of the frieze), which regulate the intercolumniations; and, lastly, the cornice (one-fifth), which projects its own height.

Grecian Ionic Order.—This was doubtless borrowed from Assyrian designs. The stylobate is from four-fifths to one diameter in height, and is divided into 3 steps. The column, 9 diameters in height, is divided into base (two-fifths of a diameter), consisting of a torus and scotia moulding, with a series of smaller mouldings above; these again are divided by fillets. The column, which diminishes to five-sixths at the hypotrachelium, is divided into 24 elliptical flutes and alternating fillets. The capital, three-quarters of a diameter in height (including the necking), is like a paper roll lying on the top of a column, with the rolls or volutes hanging downwards on each side.

Grecian Corinthian Order.—Of this order there are only two remaining specimens in Greece, all others at present standing having been built after the Roman invasion. The Choragic Monument at Athens—circular, and standing on a square pediment—is the best example. The stylobate and column are similar to those of the Ionic order, with the exception that the latter is 10 instead of 9 diameters in height. The base is two-fifths and the capital $1\frac{1}{2}$ diameters in height, composed of a cylindrical core with eight leaves clustered round it, while above are four acanthus leaves *cyma recta* in contour, surmounted by a moulded abacus curved inwards on each face. The entablature is $2\frac{2}{7}$ diameters in height, the architrave being divided into 3 horizontal fillets, separated by a narrow moulding from the frieze, on which bas-reliefs are carved; while the cornice, which has a projection equal to its height, consists of bed mouldings, corona, small crown mouldings, and fillet, surmounted by a cut fascia.

Grecian Caryatic Order.—In this order the statues of women were substituted instead of col-

umns, and rested on a stereobatic dado, which in turn stood on the stylobate. The entablature consisted of architrave and cornice alone, divided into equal portions.

Roman Doric Order.—This is a rude imitation of the Grecian design, and seldom used. In the theatre of Marcellus, Rome, the columns are 8 diameters in height, and consist of a perfectly plain shaft, tapering to four-fifths of its diameter at the neck. The capital consists of necking with torus moulding and 3 fillets below, and the abacus, equal to three-fifths of a diameter. The entablature, 2 diameters in height, has a very short architrave, perfectly plain; a deep frieze, with triglyphs half a diameter in width, and square metopes between; while the projection of the cornice is equal to its depth.

Roman Ionic Order.—This design is in many respects similar to the Grecian. The only building in Rome worthy of note is the temple of Fortuna Virilis. The stylobate is higher than that of the Grecian, and has no steps. The column, 9 diameters in height, and tapering to nine-tenths of its diameter at the neck, has 20 flutes. The base is very similar to that of the Grecian order, but the connecting band of mouldings between the volutes in the capital is horizontal instead of being bent downwards in the centre. The entablature consists of an architrave unequally divided by fasciæ mouldings; a frieze, plain, but enriched by figures and foliage; while the cornice is largely composed of carved mouldings.

Roman Corinthian.—This was the favourite order adopted by the Romans, the stylobate being similar to that of Ionic, and about 3 diameters in height. The column consists of base, shaft, and capital, 10 diameters in height—the base similar to Ionic, the only differ-

ence being that it stands on a square plinth. The shaft diminishes to seven-eighths at the neck, and it has usually 24 flutes and fillets. The capital is $1\frac{1}{2}$ diameters in height, consisting of two rows, one above the other, of eight acanthus leaves, surmounted by helices and foliage, and the abacus, with inward curved moulded faces. The entablature is about 2 diameters in height—of architrave, divided into 3 unequal fasciæ; frieze, divided from the latter by carved mouldings, and perfectly plain; and cornice, with bed-moulding of considerable projection.

Second Corinthian Order.—This order, afterwards known in Italian Renaissance as the Composite order, is similar in most respects to the Corinthian. The columns, however, were not quite so high, and have a deeper capital, which in appearance is a combination of Corinthian with 4 Ionic volutes projecting at each corner directly under the abacus. The entablature has a small architrave, divided into 3 projecting fillets; the frieze is plain; while the cornice is deep, with a large number of carved mouldings.

BYZANTINE ARCHITECTURE is the form which combines the Roman style with that used by Mohammedan nations. From the overthrow of the Western Empire in 476 A.D., little advance was made in architecture for about seven hundred years; in fact, there was rather retrogression. This was largely due to the temperament and warlike disposition of the Goths, who in the earlier stages of their conquest destroyed many of the existing temples and other buildings. But as time went on their kings began to take a livelier interest in learning and in the arts. Justinian erected (532 onwards) the magnificent church of St. Sophia in Constantinople, still standing, and used as a Mohammedan mosque. Its external appearance is that of a

high dome or aerial cupola, 106 ft. in diameter, supported on piers, commencing at a height of 182 ft. above floor-level, and pierced by twenty-four windows; while clustering round this are portions of the building, with shelving roofs gradually ascending towards the dome. The church of St. Mark, Venice, is also a splendid specimen of Byzantine work.

ROMANESQUE.—The spread of Christianity throughout Europe during this epoch caused the construction of many churches, largely based in plan and general design on the basilicas of the Romans, but with this difference, that instead of the columns being connected together by architraves on the top of their capitals, semicircular arches were used; while greater detail of carving was given to the external elevation of these buildings. The preservation of architecture was in great measure due to the religious feeling of the age; for with the exception of churches and castles, few buildings were erected. The effect throughout Europe was to form a peculiar style in each country, subdivided into Saxon, Norman, French, Rhenish, Spanish, and Italian. Correctly speaking, the architecture of these countries is Gothic; but the term has been restricted, in popular usage, to that which is characterized by the pointed arch, introduced at the end of the twelfth century.

Anglo-Saxon.—In 672 A.D. certain builders from the Continent landed in Britain. Previous to this period buildings had been composed mostly of wood, and covered with thatch; and although several were then built of stone, and glass was used for windows, it was not until near the end of the 10th century, when a church was completed on the spot where Westminster Abbey now stands, that architecture developed into a definite style, which may be termed a debased Roman.

Arches were always semicircular, and generally plain, but were sometimes decorated with moulding on soffit. The columns were cylindrical, hexagonal, or octagonal, very thick in proportion to their height, and often ornamented with herring-bone or zigzag carvings. The capitals were rude both in profile and carving, and the walls very thick, without external buttresses.

Norman.—At no time in English history was so much building accomplished in Britain as during the Norman period (1066-1200). After the conquest of the country by William I., the clergy at once commenced the erection of monasteries, cathedrals, and other places of worship; while the nobles, owing to the unsettled state of the country, built castles of great strength. They were usually erected on a commanding position partly adapted by nature as a place of defence. These buildings, which were somewhat similar to the castles of Normandy, were often placed on an eminence beside a river, surrounded by a moat on the landward side. A drawbridge gave access to the castle gate, which was protected by a barbican, or lofty wall with turrets. The main walls of the castle, from 8 to 12 ft. thick, and from 20 to 30 ft. high, were surmounted by a parapet with embrasures; while at the angles or corners high towers were erected, used for sleeping apartments and look-out stations. The granaries, stables, kitchens, and other offices connected with the castle were situated within this wall. In the centre of this space or courtyard, surrounded by another moat or ditch, was the keep or tower, four or five stories in height, where the banqueting-hall for friends and retainers was placed, while underneath were the dungeons. The most noted building of this class, still in perfect preservation,

is the Tower of London. The peculiarity of the Norman style is principally shown in massive towers and walls, with narrow apertures or loopholes for windows, the upper portions being often circular. The roofs were flat, with raised parapets or battlements with embrasures on the top of walls, towers, and turrets. Ecclesiastical architecture of this date may be termed an impressive form of Saxon. In plan, the churches are designed with transepts and nave, with a tower, but no spire, at their intersection. The eastern end of the edifice is usually semicircular; while the sides of the nave are of square, cylindrical, or octagonal columns. If the first, it has clusters of small half-columns surrounding it, and both bases and capitals are formed of simple mouldings. The arches above the columns are circular, and of greater span than the Saxon, and the ornaments bolder, with the soffits plain. In the second story two smaller arches are inserted, springing from a small central pillar; and in the third story there are three arches, the central being higher than those on each side, the width of the double and treble windows combined being the same as the width of the main arch below. In many the mouldings and carving are profuse, and are formed of several distinctive types, such as (1) the chevron or zigzag, (2) the embattled fret, (3) the triangular fret, (4) the billet, (5) the cable, (6) the hatched, (7) the lozenge, (8) the wavy, (9) the pellet, and (10) the nebule. The torus and cavetto were also used. The western towers and nave of Ely Cathedral, the choir at Canterbury, and almost the whole of Durham, Peterborough, and Rochester Cathedrals, are splendid examples.

French.—The style of architecture in France contemporaneous with that of the Norman period

may also be designated as a debased form of Roman. During the 9th and 10th centuries the country was the scene of turmoil and bloodshed, and it was not until the dawn of the 11th century that art again began to flourish, and churches, such as St. Germain des Près in Paris, were erected.

Rhenish.—During this period many fine churches were built in Germany, the more important being those of Mainz, Worms, and Spire. The plan, like those of England and France, is cruciform, and consists of the nave, usually lofty, and enclosed by groined vaulting, with side aisles, while the choir and chancel terminate in the apse. The mouldings are purely Roman. The cathedral of Worms is a perfect example of the period.

Italian.—There is a considerable difference in design between Italian and German ecclesiastical buildings of this period, the most important being the addition in the former of the campanile tower. In erecting their churches, the Italians often used the columns and relics of antiquity removed from former Roman buildings. The cathedral at Pisa is one of the best examples. The plan is that of a Latin cross. On each side of the nave are two aisles, divided by Corinthian columns, from whose capitals spring arches, on the top of which is another row of smaller and more numerous Corinthian columns, surmounted by a wall with circular-headed windows. The transepts are also divided into nave and side aisles, and at the intersection with the main nave are four piers, which support an elliptical cupola. The front elevation has five stories of columns and arches, the lowest consisting of seven large arches; the second of twenty-one small arches; the third with the same number, the outer ones being partly reduced to the slope

of the side roof; the fourth of nine arches, the columns being higher than the two stories below; and the fifth has the same number, but reduced in size towards the sides, as the main roof forms a triangular pediment. The bell or campanile tower, also known as the leaning tower, of Pisa, built in 1174, is one of the peculiar architectural developments of the period. It is cylindrical in shape, 180 ft. high, 50 ft. in diameter, and is canted 13 ft. from the perpendicular, owing to defective foundations.

GOTHIC OR POINTED.—About the end of the 12th century a wonderful change came over the architecture of Europe. In all countries we have the simultaneous appearance of the pointed arch. That this peculiar form of design had not been used before is curious, as it was certainly known in the East. The date, however, is synonymous with the first crusade—a war in which all the nations of Europe took an active part. It is, therefore, probable that in the Holy Land the crusaders received their first inspiration in a style of architecture which for centuries gave an impetus to the development of Gothic or Pointed in its many varied forms. At first it was a simple lancet arch; but by degrees, through adding clustered pillars, mullions of manifold form, and tracery, a degree of perfection and refinement was obtained never before dreamt of.

English Gothic.—The first examples, during the reign of Richard I. (1189-99), exhibited gracefulness in detail and general character, with a desire to attain an appearance of lightness and elegance which must have necessitated a thorough knowledge of building construction. Slim marble columns and mouldings of a very refined type were introduced. The groined roofs were

simple in design, but ridge ribs were sometimes added. Two of the finest types of castles built at this period were Carnarvon and Conway, which, although similar in plan to those of the Normans, exhibited a considerable quantity of Gothic detail. Of ecclesiastical buildings, the transepts of York, Lincoln, and Salisbury Cathedrals are the best examples. In 1307 the style became changed to what is known as Middle Pointed, in which stone traceries of geometrical pattern were introduced into windows. Mouldings took the place of slim columns, while the under side of groined arches were profusely decorated with fine tracery or mouldings radiating from the springers, as is so beautifully typified in Westminster Abbey. At last the style became so over-decorated that in 1399 a reaction set in, which resulted in the Perpendicular or Third Pointed style. The nave of Winchester is perhaps the best example. Instead of the mouldings being in curves and flowing lines as formerly, a greater severity and boldness of design were displayed by having a predominance of vertical or horizontal mouldings. In Scotland many beautiful churches were erected, such as Dryburgh and Pluscarden Abbeys, which are similar in design to those of England; but in a very short time the Scots introduced a national style, beautifully exemplified in Elgin, Kirkwall, Glasgow, and St. Andrews Cathedrals, in Holyrood and Melrose Abbeys, and in Roslin Chapel.

Continental Gothic.—The Gothic architecture of the Continent was affected largely by the basilica plan, which necessitated the retention of the apse, surrounded by aisles and chapels. In France the roof vaulting was much loftier, and generally of stone instead of timber. In beauty of design and

intricate planning, these ecclesiastical buildings are unique; Amiens, Rheims, Notre Dame in Paris, Rouen, and Chartres are among the finest examples. In Germany the apse was also largely used, and sometimes at both ends of a church, but without surrounding aisles and chapels. The main building is often under one vast roof, covering in both aisles and nave; the columns are of exceptional height; while the external walls are generally arcaded by open galleries directly under the eaves. Cologne, Marburg, and Strassburg Cathedrals are the finest examples. Of Spanish cathedrals there are several magnificent specimens, those of England and France being small in comparison. In their earlier buildings there is a slight appearance of Moorish architecture, but those of later date are distinctly French. Stone vaulting is predominant, while in the cathedral at Gerona the width of the nave measures 73 ft. Seville, Salamanca, and Toledo Cathedrals are also good examples. Italy does not possess the same number of grand Gothic buildings as the other countries of Europe. Milan Cathedral, although magnificent in scale and full of rich detail, is badly planned. The Italians also adopted a distinct style by variegating the colour of the stones used in construction, as shown in St. Mark's at Venice. Como and Orvieto are other cathedrals of note.

ITALIAN ARCHITECTURE.—We have observed that Gothic architecture never gained such popularity in Italy as in other European countries. As early as 1296 the church of Santa Maria del Fiore, Florence, was commenced; but it was not completed till 1474, although the original plan was adhered to. During the 178 years it was under construction, the different ideas of the various architects

are plainly visible in the forms of decoration and style. In 1407 Brunelleschi, a Florentine architect, who had visited and studied the ruins of ancient Rome, returned to Florence, and gave the initial impulse to what may be termed the revival of Roman architecture. In the dome of Santa Maria we have a specimen of his work. The church is 454 ft. and the transepts 334 ft. in length; the nave is 153 ft. and the side aisles 96 ft. in height; while the top of the dome is 387 ft. above the floor-level. The revival commenced by Brunelleschi was continued by Leo Battista Alberti, who wrote no less than ten books on architecture, which give one an insight into the refined taste and thorough knowledge of building construction as known to these old masters. It is a matter of regret that, about this time, the ancient book on architecture by Vitruvius was translated, in which certain erroneous rules of proportion were laid down for the design of the orders and their mouldings; and these, as we now know after personally studying the ruins of ancient Greece and Rome, were of a most perfunctory character, and did considerable harm to the Italian school. The founders of this school called themselves Cinquecentists, and thought they had found the ideal architecture. In addition to the three orders (Doric, Ionic, and Corinthian) before mentioned, a second form of Corinthian was termed the fourth or Composite; and a new or fifth order, called Tuscan, was adopted, though it was only a debased form of Roman Doric.

The Italian school was divided into three distinct sections—Florentine, Roman, and Venetian—each having its peculiar style, largely due to the habits of the people and the materials at command.

To the *Florentine school* we are indebted for many of the designs in street architecture of the present day. The Pandolfini Palace is a notable example, and shows how often this style, although severe, is now reproduced with slight alterations in our dwelling-houses and public buildings. The *Roman school* adopted a style which, instead of representing that massiveness and fortress-like appearance of the former, had a gracefulness and lightness of design formed by breaking up the exterior walls by pilasters and columns. An elaborate entrance was also one of the principal features. The grandest building in Rome, commenced during the time of Pope Julius II., was St. Peter's. The designs of Bramante having been adopted, the work was commenced in 1506; and although beautiful and artistic in conception, the building is too light in form. This was proved when the roof vaulting was commenced, as the four main piers which were to support the cupola cracked. After Bramante's death the work was strengthened and carried on by several architects until the time of Michael Angelo, who made (1546-64) the erection of this vast building his life's work. When he died he had completed so much of the edifice that it was impossible for any other person to alter the design. The extent of the building is enormous, covering an area of more than 5 ac.; while the summit of the cupola, which is 139 ft. in diameter, is 432 ft. above pavement-level. The palaces of Rome, rectangular in shape, with an inner court, were generally constructed externally of brick. The Farnese Palace, three stories in height, is one of the finest, and is thus constructed. The inside arcades, facing the court or *loggia*, are composed entirely of stone columns, each story being de-

signed in a different order, while the various apartments lie towards the outside walls. The villas, erected in the outskirts of Rome, were lighter in design than the palaces, and in many cases had handsome façades, while their plan of arrangement exhibited great ingenuity. From those models the designs of many British country houses have been copied.

The *Venetian school* displayed an elegance in design due largely to the use of columns in the façades of their buildings, with arched apertures for windows. The palace of Pompei at Verona and St. Mark's Library at Venice are two of the best examples. One of the most celebrated architects of the time was Andrea Palladio, whose works retrieve in many respects the deformities and constant application of absurd rules largely indulged in by his contemporaries. This style embraced the great necessity of all architecture—*i.e.* accommodating interior convenience with external effect, without displaying harshness or want of proportion. Many of his buildings, which exhibit great simplicity, were copied by Wren, Inigo Jones, and other British architects, because his designs were effective, and could be constructed at a minimum cost. The Villa Capra is an example of Palladio's work.

FRENCH RENAISSANCE was introduced into France in the 16th century, and soon developed into a special style. In Paris we have the finest street architecture in Europe. Many of the buildings—such as the Louvre, the palaces of the Luxembourg, Tuileries, and Versailles, the Hôtel des Invalides, and, lastly, the Panthéon, one of the finest churches ever erected—may rank among the most beautifully designed edifices in Europe.

In Germany there are few typ-

ically national specimens of revival architecture, because the buildings erected at this period were either by French or by Italian masters. In Spain and Russia we find buildings similar to those of Italy, and with no outstanding or exceptional form either in plan or in elevation.

ENGLISH REVIVAL OR RENAISSANCE.—In Britain the Cinquecentists did not obtain a footing until the reign of Elizabeth, fully one hundred years later than on the Continent. During this period many changes had taken place in the style of architecture. Gothic architecture had declined, and in its final stages became known as the Florid or Tudor style, which exhibits a complexity and richness of ornament in ecclesiastical buildings. The outstanding peculiarities of this style are arches abnormally flat, and wide in proportion to their span; windows of the same description, and divided by transoms with small embattled ornaments as mouldings; and ceiling vaulting covered by an innumerable variety of interlacing ribs with pendent carvings. Specimens may be observed in the cathedrals of Gloucester, Peterborough, Ely, and St. George's Chapel, Windsor. In domestic architecture great advance was made. Castles, mansions, and country houses were built on a magnificent scale, both as regards planning and elevation. Projecting bay windows divided by mullions and transoms, hexagonal or octagonal towers and very high chimneys, and entrance doorways highly ornamented with mouldings and carving, were the principal features of the time. Unfortunately, few of these buildings now remain. Among the best examples are Haddon Hall, Derbyshire; Raglan Castle, Monmouthshire; Wolterton, Norfolk; and Harlaxton, Lincolnshire.

Elizabethan or Late Tudor

Style.—This became predominant, exhibiting in design a combination of the former with that of the Cinquecento school. The buildings are well arranged in plan, but the combination of the two styles is grotesque, and not pleasing to the eye. Longford Castle, Wiltshire; Hatfield, Herts; and Wollaton Hall, Nottinghamshire, are among the most typical. Another style copied from the Continent was that of dwellings built with timber frames, filled in with harled brickwork, while the roofs are tiled, the result being a picturesque and artistic whole. In the town of Chester there are still some of these old buildings.

During the reign of James I., Inigo Jones was the most famous architect. His design for a palace at Whitehall (the only part ever completed being the banqueting-hall) might have ranked as the finest in the world. The Great Fire in London took place shortly after his death (1666), and then it was that Sir Christopher Wren's genius became known. During his lifetime he had the good fortune to see his design for St. Paul's Cathedral, London, carried out. It was begun in 1675, and finished thirty-five years later. In the form of a Latin cross, it has a length of 500 ft., and a breadth across the transepts of 250 ft. Above the intersection of nave and transepts is the dome, 100 ft. in diameter, springing at a height of 168 ft. above the floor. The height from pavement-level to the top of the cross is 330 ft. No less than twenty-five churches in London alone were designed by Wren, several of them Gothic, and exhibiting very refined taste. He was also the architect of Greenwich Hospital, the Monument, and Temple Bar. Sir John Vanbrugh, who succeeded Wren, adopted the massive style as his ideal, his finest work being Blen-

heim Palace. During the earlier part of the 18th century Hawksmoor, Keith Gibbs (a Scotsman), and Page were among the most celebrated architects; while towards its close we find Sir William Chambers, Sir Robert Taylor, and James Wyatt in the foremost rank. Chambers designed Somerset House, one of the most beautiful examples of Italian architecture, while many of his works are scattered throughout England. Stuart and Revett made many researches, and personally studied the works of ancient Greece, but it was some time before the beauty of their art was fully appreciated. The brothers Adam attempted to imitate them, but not always with success.

PRESENT-DAY ARCHITECTURE.

—In earlier times every country had a style or styles peculiar to itself, but nowadays we find the art of building has become truly cosmopolitan. This change has been brought about by increased communication all over the world. In striving after originality, designs are often produced of such incoherent style that they inspire curiosity rather than admiration.

The now universal use of iron-work in buildings has had the effect of spoiling, through the light appearance of the substructure, the external appearance of many buildings which otherwise might have been extremely handsome; yet it has been of immense advantage in regard to internal arrangement. The value of ground in the centre of our large cities is causing the rapid demolition of old dwellings, which are generally replaced by buildings of great height, substantially built, and containing apartments of a fixed minimum height and area, according to rules laid down by local authorities. See Waring's *Stone Monuments and Tumuli of Remote Ages* (1870); Dodwell's *Cyclopean Remains in Greece and Italy* (1834);

Bollaert's *Antiquarian Researches in New Granada, Ecuador, Peru, and Chili* (1860); Rich's *Koordistan* (1836); Fergusson's *Nineveh and Persepolis, and History of Architecture*; Cockerell's *Antiquities of Athens* (1830); Taylor and Cressy's *The Architectural Antiquities of Rome* (1821-2); Pugin's *Gothic Architecture* (1836); Bond's *Gothic Architecture in England* (1905); Gotch's *Early Renaissance Architecture in England* (1901); Winkles's *French Cathedrals* (1837); Wild's *Architectural Grandeur* (1837); Stevenson's *House Architecture* (1880); Gwilt's *Encyc. of Architecture* (1888); and Sturgis's *Hist. of Architecture* (1910). See also *The Builder* (weekly).

Architrave, the lowest of the three principal members of the entablature (the other two being the frieze and the cornice), and the chief beam in it, resting on the columns. An architrave cornice is an entablature consisting of an architrave and cornice only, without a frieze; and the architrave of a door or a window is a collection of members and mouldings round either.

Archives. See RECORDS.

Archivolt, the ornamental band of mouldings round an arch. The word is also used by mediæval writers for a vault.

Archon, the chief magistrate in Athens after the abolition of the kingship, appointed at first for life. This life-tenure was reduced to a period of ten years, probably about 750 B.C. In 683 the office became annual. Meanwhile the office of king was retained, though eventually it became an annual office, the second archon being called *archon basileus* ('king archon'), who had charge of the sacrifices, etc., which had to be performed always by at least a nominal king. Early in the 7th century B.C. there were three archons—the third being the *po-lemarch*, the commander in war.

About 650 B.C. the six *thesmothetai* ('keepers of the law') were joined with them, as forming one college of nine archons. Originally nobles alone could become archons; but by 600 B.C. the qualification became one of wealth. Solon (594 B.C.) provided that the nine archons should be chosen by lot out of forty elected candidates. Cleisthenes's institution of a new office, the *strategia*, or generalship, weakened the archons' power, as the *strategi* came to monopolize the state business. On the two lower classes being made eligible for the archonship, the office became a paid one. See Aristotle's *Constitution of Athens*.

Archpriest, a church dignitary whose office was formerly given in each diocese to the priest senior by ordination. He was the helper of the bishop in his spiritual functions, as the archdeacon was in his temporal functions. Along with the parish priests he formed the rural chapter corresponding to the cathedral chapter of the bishop and canons. In the Roman Catholic Church the title has fallen into desuetude. In England, from 1598 to 1623, archpriests (George Blackwell, 1598-1608; George Birket or Birkhead, 1608-14; Dr. William Harrison, 1615-21) were appointed by papal commission to take charge of the secular clergy. They were vigorously opposed by the English clergy, who finally obtained their supersession in favour of William Bishop (1623) as bishop's vicar-general.

Archytas OF TARENTUM (c. 400 B.C.), Greek general and mathematician, and a friend of Plato, was the first to apply geometry to mechanics. He is known only by references in ancient writers.

Arcidosso, tn., Tuscany, Italy, prov. of and 35 m. N.E. of Grosseto. Manufactures woollengoods. Pop. 8,000.

Arcis-sur-Aube, tn., dep.

Aube, France, 17 m. N. by E. of Troyes; birthplace of Danton, and scene of the battle of March 20-21, 1814, when Napoleon was forced to retreat, leaving the route to Paris open to the allies. Pop. 2,800.

Arcole, vil., Italy, in prov. of and 15 m. S.E. of Verona, in a marshy situation; was the scene, on Nov. 15, 16, and 17, 1796, of stubborn battles between the Austrians (about 40,000, under Alvinczy) and Napoleon, in which the latter finally gained a victory which prevented the relief of Mantua. Pop. 3,400.

Arçon, JEAN CLAUDE ELÉONORE LE MICHAUD D' (1733-1800), French general and engineer, born at Pontarlier; the inventor of the floating batteries used in the attack upon Gibraltar in 1782. He took an active part in the wars of the French revolution, and wrote military books, such as *Considérations sur les Fortifications* (1795).

Arcos de la Frontera, tn., prov. Cadiz, Spain, 19 m. N.E. of Jerez. Finely situated on rocky elevation. Formerly on the Moorish frontier; it was once strongly fortified. Pop. 14,000.

Arcot, tn., N. Arcot dist., Madras, 65 m. W.S.W. of Madras; was formerly the capital of the Carnatic. The fort, now in ruins, was taken by Clive in 1751; by the French in 1758, from whom it was recaptured in 1760. During the Mysore war, Arcot was taken by Haidar Ali in 1780, and finally passed into the hands of the British in 1801. Pop. 11,000.

Arcot, NORTH (area, 7,616 sq. m.), a district of the Madras Presidency; formed part of the kingdoms of Carnatic and Mysore, and at the termination of the Mysore war was ceded to the British. Paddy, ragi, and cholam are grown, and there are manufactures of carpets, brass work, and carved wood. Pop. 2,210,000.

SOUTH ARCOT (area 5,217 sq. m.)

has similar productions. Fort St. David, 2 m. to the N., was taken by the French in 1758, and abandoned two years later. Pop. 2,350,000.

Arctic Exploration. The Arctic Sea was first entered by Otho, a Norwegian, who sailed to the N. coast of Russia, and made a report of his voyage to King Alfred; and about 1001 the W. coast of Greenland was colonized by the Icelfander, Erik the Red. No further progress, however, was made in Arctic discovery until 1553, when Sir Hugh Willoughby sighted Novaya Zemlya. Three years later the Kara Str. and Kolguyef I. were discovered by Stephen Burrough, and in 1580 the Yugor Str. by Pet and Jackman. Dutchmen soon joined in the quest. William Barents (Barendszoon or Barendsz) made three voyages to the north, and in 1596, having discovered Bear I. and Spitzbergen, rounded the N. extremity of Novaya Zemlya, and wintered on the E. coast. This was the first time Europeans passed a winter in the Arctic regions. Novaya Zemlya was first circumnavigated by Elling Carlsen in 1871. Henry Hudson, in 1607, sailed up the E. coast of Greenland to Cape Hold with Hope, and crossing over to Spitzbergen, named Hakluyt Headland. On his return he discovered Hudson Tutches, afterwards named Jan Mayen after a Dutch skipper. In another voyage, in 1610, the same navigator discovered Hudson Strait. Thomas Edge, in the employment of the Muscovy Company, besides other discoveries, sighted and named Wyche's Land (1617), renamed by Von Heuglin in 1870, after the king of Würtemberg, König Karl Land. In 1707 the Dutch captain Giles, or Gillis, sighted land 25 m. E. of N.E. Spitzbergen, which has been sought for in vain by later navigators. Parry, in 1827,

reached, by means of boats, the lat. of $82^{\circ} 45'$ to the N. of Spitzbergen—the farthest north until the Nares expedition. Nordenskiöld made several voyages to this group, on one of which (1868) he carried his vessel, the *Sophie*, to $81^{\circ} 42'$ —a record on the European side of the Arctic beaten only by the *Fram*. Captain Carlsen (1863) was the first to sail round Spitzbergen. In 1872 Payer and Weyprecht discovered Franz Josef Land. On the chart of the Van Keulens the Land van Edam and Land van Lambert are marked on the E. coast of Greenland in lat. $78^{\circ} 10'$ and $78^{\circ} 20'$ respectively. These points were seen in 1655 and 1670. A Dutch skipper, Gael Hamke, discovered the bay which bears his name in 1654. In 1822 Dr. Scoresby surveyed it from Gael Hamke Bay down to lat. 69° ; and in 1823 Clavering and Sabine, in the *Griper*, made pendulum observations at Pendulum I., and advanced north to the Haystack. The S. extremity of the E. coast was visited by Captain Graah in 1829, and explored up to $65^{\circ} 18' N$. More important was the first German expedition of 1869–70 in the ships *Germania* and *Hansa*, under the command of Captain Koldewey. Accompanied by Lieut. Payer, Captain Koldewey reached with sledges the N. shore of Dove Bay, N. of Cape Bismarck, in lat. $77^{\circ} N$.; while the crew of the *Hansa*, which was crushed by the ice, made a remarkable journey on an ice-flow to the S. extremity of Greenland. Frobisher and Hall made voyages to the W. coast of Greenland and the opposite American coast; but the entrance to the Arctic regions W. of Greenland is the strait discovered by John Davis in 1585. In 1616 Baffin and Bylot passed through this strait, and sailed up the North Water to Smith Sound, discovering on the homeward voyage Jones Sound and Lancaster

Sound. Except for the voyage in 1631 of Luke Fox, who sailed up Fox Channel to Peregrine Point, in lat. $66^{\circ} 47'$ N., nothing further was learned of these regions for about two hundred years. The interest in a North-West Passage having revived, Commander John Ross was sent out in 1818 with the *Isabella* and *Alexander*. He confirmed the accuracy of Baffin's observations, and named Melville Bay, Capes Isabella and Alexander, and other points. The following year Lieut. Parry, commanding the *Hecla* and *Griper*, sailed through Lancaster Sound, and laid down on his chart the islands of N. Devon, Cornwall, Bathurst, and Melville on the N., and N. Somerset, Cape Walker (Russell I.), and Banks Land on the S.; and in 1821-3, with the *Fury* and *Hecla*, he passed up Fox Channel and traced the Fury and Hecla Straits to Regent Inlet. Sir John Ross made another voyage in 1829-33 in the *Victory*, a vessel equipped by Felix Booth, a wealthy distiller, and passed up Regent Inlet to the Gulf of Boothia; while his nephew, J. C. Ross, traversed the S. part of Boothia and the strait named after him, and discovered the north magnetic pole, then situated in lat. $70^{\circ} 5'$ N. and long. $96^{\circ} 46'$ W., on King William Land, not the portion of Greenland also known by that name. A few years earlier, in 1826, Dr. Richardson had passed through Dolphin and Union Straits, and sighted Wollaston Land, part of which was afterwards named Victoria Land by Simpson of Hudson's Bay Company, who, with Dease, in 1838-9, passed through Dease Str. and the entrance of Simpson Str.; while Dr. John Rae, in 1845-7, explored the S. coast of the Gulf of Boothia from Fury and Hecla Straits on the E. to Lord Mayor's Bay on the W., and proved Boothia to be a peninsula. The

successful though ill-fated expedition of Sir John Franklin in search of a North-West Passage set sail from the Thames on May 20, 1845. With the *Erebus* and the *Terror*, under the command of Captains Fitzjames and Crozier, Franklin passed through Lancaster Sound, and, as was afterwards ascertained, sailed up Wellington Channel to Penny Strait and down Crozier Channel, returning to Beechey I. in winter. Subsequently the vessels made their way to the N.W. coast of King William Land, where Franklin died in June 1847. The survivors, under Captain Crozier, started in 1848 for the Great Fish River, and their remains were found along the route to Adelaide Peninsula. The expedition had, therefore, ascertained the existence of a sea passage from the Atlantic to the channels S. of Victoria and Wollaston Land, leading to Bering Str. Nothing having been heard of Sir John Franklin and his vessels, some forty expeditions were sent out between the years 1847 and 1857, during which many new discoveries were made. Of those entering the Arctic regions from the E. may be mentioned that of Lieut. De Haven, of the U.S. navy, in the *Advance*, equipped by Mr. Grinnell, who, sailing up Wellington Channel, named Grinnell Land, to the N.W. of N. Devon; that of Captain Austin of the *Resolute* (1850-1), who, with Lieut. M'Clintock, surveyed the S. shores of the Parry Is.; the expedition of Sir E. Belcher, with the ships *Assistance*, *Resolute*, *Pioneer*, *Intrepid*, and *North Star* (1852-4), when the commander of the expedition surveyed the Belcher Channel, Lieut. Sherard Osborn the N. shores of the Parry Is., and Lieuts. M'Clintock and Meham Prince Patrick I.; while, in 1857-9, Captain M'Clintock, in the *Fox*, sailed up Regent Inlet, and established his winter quarters at Port

Kennedy in Bellot Str. (discovered in 1851-2 by Captain Kennedy and Lieut. Bellot of the French navy), whence sledge parties, under the command of Captain Allen Young and Lieut. Hobson, set forth to examine the w. coast of N. Somerset and Boothia, the s. coast of Prince of Wales I., and the shores of King William Land. On the w. coast of the last-named island was found a paper recording the voyage of the ships *Erebus* and *Terror*, the death of Franklin, and the departure of the crews for the Great Fish River; and traces of their journey were discovered at many points as far N. as Montreal I., at the base of the Ogle Peninsula. Since then remains have been found and relics collected by Dr. Rae, Captain Hall, and Lieut. Schwatka. Meanwhile, Dr. Kane, who had accompanied De Haven, led another Grinnell expedition, in 1853-5, up through Smith Sound to Kane Basin, whence Dr. Hayes explored the coast of Grinnell Land (N. of Ellesmere Land, not the Grinnell Land of De Haven) up to lat. $79^{\circ} 45'$, and Wm. Morton the Humboldt glacier and Washington Land. In a second journey, made in 1860-1, Dr. Hayes reached Cape Lieber, lat. $81^{\circ} 35'$, and made an excursion into the inland ice of Greenland, on the N. side of Inglefield Gulf. Captain C. F. Hall, in 1871, carried his vessel, the *Polaris*, up to $82^{\circ} 16'$ N. lat., and wintered in Polaris Bay, N. of Petermann Fjord. He was followed, in 1875-6, by the Nares expedition, with the ships *Alert* and *Discovery*. The *Alert* wintered off the coast of Grinnell Land, in lat. $82^{\circ} 24'$; the *Discovery* in Discovery Harbour, opposite Polaris Bay. Sledge parties were sent out, one of which, under Commander A. H. Markham, drove northwards over the ice to lat. $83^{\circ} 20' 26''$ N.; a second, under Lieut. Aldrich, explored the N. coast of Grant Land; and a third, under

Lieut. Beaumont, reached the farther coast of Sherard Osborn Fjord. Lastly, in 1881-4, Lieut. Greely, U.S.A., led an expedition up Kennedy Channel, and, with the assistance of Lieut. Lockwood, explored the interior of Grinnell Land westwards to the Greely Fjord, while the latter followed the coast beyond Sherard Osborn Fjord to Lockwood I., $83^{\circ} 24'$ N.—the highest latitude reached by man until the Nansen expedition.

Several exploring vessels have entered the Arctic seas by Bering Str. Captain Cook reached Icy Cape in 1778, and Captain Beechey, in the *Blossom*, tried, in 1826, to meet Sir John Franklin, who skirted the coast from the Mackenzie; but he did not get farther than Point Barrow. The greatest expedition by this route was that of the *Investigator* and *Enterprise*, under Captains M'Clure and Collinson (1850-4), which explored the w. coast of Wollaston Land and the coasts of Banks Land, while M'Clure and his crew made the North-West Passage on the ice, being received by Captain Kellet of the *Resolute* in Melville Sound, and taken home by the *North Star*. Another important voyage was made through Bering Strait in 1879-81. Lieut. De Long of the U.S. navy set sail towards the pole in the *Jeannette* (Captain Allen's yacht *Pandora*), and having ascertained that Wrangel Land (seen first by Baron Wrangel from the Chukchi coast in 1824, and supposed to be of great extent) was only a small island, drifted with the ice past Jeannette and Henrietta Islands, and, his ship being crushed in the ice, endeavoured to reach the river Lena. One party, under the command of Engineer Melville, reached Yakutsk, and afterwards found and buried the bodies of De Long and some of the crew on the Lena delta. About the same time (1878-9) Baron Nordenskiöld made

the North-East Passage in the ship *Vega*.

During recent years a large number of expeditions have visited the Arctic regions. Lieut. (now Commander) Peary has spent several seasons in Greenland and on the neighbouring coast. In 1892, accompanied by Eivind Astrup, he crossed the N. of Greenland to Independence Bay, in lat. $81^{\circ} 37'$ N.; and, in 1899, crossed Ellesmere Land, and connected his survey of the w. coast with that of Lieut. Lockwood. In 1900 he reached lat. $83^{\circ} 50'$ to the N. of Greenland, and in 1902 lat. $84^{\circ} 17'$ to the N. of Grant Land. Nansen entered the ice with the *Fram* near the New Siberia Is. in 1893, drifted during two winters towards the pole, and with Johansen marched over the ice to lat. $86^{\circ} 14'$ N., while the *Fram* reached lat. $85^{\circ} 57'$ to the N. of Spitzbergen. Mr. F. C. Jackson of the Jackson-Harmsworth expedition, spent the years 1894-7 in Franz Josef Land. The Duke of the Abruzzi has also visited this group in the *Stella Polare*, and one of his party, Captain Cagni, advanced in 1900 to $86^{\circ} 34'$ N. Danish officers have explored parts of the coast of Greenland; and Swedes, Russians, Britons, Germans, and others have made scientific investigations in Spitzbergen. In 1897 Andrée with two companions started from Spitzbergen in a balloon for the pole, but were never again heard of. Captain Sverdrup (1898-1902) visited Jones Sound, and determined the western side of King Oscar Land, Ellesmere Land, and Grinnell Land, and the connection between North Devon I. and the Grinnell Land immediately to the N.W. of it, as well as discovered the large islands Ringnes Is. and Axel Heiberg I. to the w. of Grinnell Land, the explorations of the sledging parties extending to 106° W. long. and $81^{\circ} 40'$ N. lat.

Amundsen, a Dane, in 1903-5 was examining the region of the north magnetic pole on King William Land (N. of Canada); and with the *Gjoa* he was the first to complete the navigation of the North-West Passage, reaching Fort Egbert, Alaska, in Dec. 1905. During 1906-7-8 Wellman, an American, made several attempts to reach the North Pole from Spitzbergen by means of a dirigible airship, but on every occasion was unsuccessful. In 1905-6 Commander Peary, in the *Roosevelt*, was again in the Arctic, and on April 21, 1906, he reached the then record distance north of $87^{\circ} 6'$ —within 200 miles of the pole. The Denmark Greenland expedition under Erichsen, which sailed north in 1906, was specially unfortunate in suffering the loss of its leader and two other members in Nov. 1907. During 1908 several expeditions were in the Arctic. The record of Arctic discovery in 1908-9 was dramatic in character. In Sept. 1909, an American explorer, Dr. F. A. Cook, arrived at Lerwick, and announced that he had reached the North Pole on April 21, 1908. Owing to the absence of corroborative scientific evidence, Dr. Cook's account of his achievements met with a certain amount of scepticism. Less than a week later a telegram announced the arrival at Indian Harbour of Commander Peary on board the *Roosevelt*, with the news that he had reached the North Pole on April 6, 1909. Peary's claim was undisputed, while that of Cook has since become utterly discredited. Around the pole Peary found a sounding of 825 fathoms, so that it is almost certain that the extreme N. of the globe, in contradistinction to the extreme S., is deep sea. The minimum temperature at the pole was -33° F., and the maximum -12° F. There is no doubt that Peary was fa-

voured with exceptionally fine weather, which greatly aided him in achieving the goal which had been his aim on several former voyages, and the aim of so many explorers before him. Interest in polar exploration has not flagged, and in 1910 further expeditions set out, and still others are projected. See Barrow's *Chronological History of Voyages into the Arctic Regions* (1818); Scoresby's *Account of the Arctic Regions, etc.* (1820); Richardson's *The Polar Regions* (1861); C. R. Markham's *The Threshold of the Unknown Region* (1873); Nourse's *American Explorations in the Ice Zones* (1884); Nordenskiöld's *The Voyage of the Vega* (1883); Jackson's *A Thousand Days in the Arctic* (1899); Sverdrup's *New Land* (1904); Hoare's *Arctic Exploration* (1906); Fiala's *Fighting the Polar Ice* (1906); Peary's *Nearest the Pole* (1907); Amundsen's *The North - West Passage* (1908); Bryce's *The Siege and Conquest of the North Pole* (1910); and Peary's *The North Pole* (1910).

Arctic Life. The Arctic zone forms a well-defined geographical region, characterized by many peculiar animals and plants. In certain parts—as, for example, in the interior of Greenland—this region is singularly barren and devoid of life; but elsewhere, as in the tundras of Asia, there is, during the brief but hot summer, an exceedingly luxuriant growth of plant life, with a corresponding abundance of insects, birds, and herbivorous and carnivorous mammals. There are relatively few kinds of herbivorous mammals, though, as in the case of lemmings and reindeer, those present may be numerous in individuals. Many Arctic animals depend directly or indirectly upon the marine organisms with which the Arctic Ocean teems. This is true of man, no less than of such characteristic Arctic

forms as fur seals, walruses, and polar bears; of entirely aquatic forms like the whales; and of the flocks of birds which are temporary inhabitants of the region.

Among the land plants the mosses and lichens deserve special mention, on account of their abundance and importance as food for the reindeer, musk ox, and lemming. Among mosses, the bog moss (*Sphagnum*), as well as species of *Hypnum* and *Polytrichum*, are common, and cover vast tracts. The so-called 'Iceland moss' (*Cetraria islandica*), which forms an important part of the reindeer's diet, is also exceedingly abundant. In addition, there are many different kinds of flowering plants whose botanical interest is greatly accentuated by the fact that they also occur as 'living fossils' on the tops of Scottish mountains. Among such may be mentioned the pink *Andromeda polifolia*, the cloudberry (*Rubus chamaemorus*), various rushes and sedges, and saxifrages. Within the Arctic region proper trees do not occur, the Arctic species of willow and birch being low-growing plants—herbs rather than shrubs. The majority of the plants display what are known as xerophytic characters (*cf.* article on the SEASHORE), and many possess rounded or centric leaves, which have not an upper and lower surface, but stand erect, and are structurally arranged so that light falling on any part of the surface can be utilized in assimilation. This is an adaptation to the peculiar conditions of illumination, the light falling on every side of the plant in turn. Again, the continuity of the light during the brief period of summer checks growth, so that the plants are dwarfed and tufted in habit. Further, although insects are numerically abundant, they are largely short-tongued forms, such as flies (*Diptera*), and the flowers are therefore mostly

short-tubed, with honey near the surface; very many are self-fertilized, and where self-fertilization is impossible, the power of asexual reproduction is marked.

The plant life of the sea would not appear to be of great direct importance. Indirectly, the algæ, both large and small, are of great importance, as they furnish ultimately the food upon which the numerous crustaceans, molluscs, fish, and other marine organisms depend. The molluscs especially are of much interest, for many of those now living in the Arctic Ocean also occurred in British seas during the Glacial Period, and are abundantly represented as fossils in Pleistocene deposits. Among such may be mentioned *Pecten islandicus*, *Astarte borealis*, *Turritella polaris*, *Leda rostrata*. Many others are now rare or absent in the south and west of Britain, but are abundantly represented in the north and east. Among such are *Cyprina islandica* and *Fusus islandicus*. Among other molluscs should be mentioned *Mya truncata* and *Saxicava arctica*, which are very abundant, and constitute the chief food of the walrus; the pteropods, *Clio borealis* and *Limacina arctica*, which form the staple diet of the whalebone whale; and the cuttles, which feed many of the toothed whales. The Crustacea also deserve passing mention. Crabs are few, but shrimps, schizopods, and amphipods are abundant; in the case of the ill-fated Greely expedition they formed the only food obtainable by the survivors. In certain parts of the Arctic region fish are extraordinarily plentiful, and reach a large size. They form a very important part of the diet of many Arctic mammals.

Of the terrestrial animals, the birds in certain regions are very abundant during the summer months. The valuable eider duck, cormorants, mergansers, oyster

catchers, puffins, guillemots, terns, auks, razor-bills, and many others, literally darken the air in the vicinity of their breeding haunts. In the tundras such land birds as the ptarmigan, the golden plover, and the phalarope abound. The first named, like so many of the Arctic mammals, becomes white in winter.

The mammals themselves show many striking peculiarities. As the conditions throughout the region are very uniform, a dominant species is likely to be widely distributed. This is true of the reindeer (*Rangifer tarandus*) and the elk (*Alces machlis*); the musk ox (*Ovibos moschatus*), now confined to the northern parts of the W. Hemisphere, is an apparent exception, but it occurs as a fossil in Europe and Asia, and was undoubtedly once widely distributed. Among other interesting forms should be mentioned the fossil mammoth (*Elephas primigenius*), which constitutes a very important source of fossil ivory; the lemming, important on account of its fecundity; the Arctic fox, which, like the marten, ermine, sable, and others, exhibits a seasonal change of colour, and forms a valuable fur animal. Of even greater importance are the aquatic or semi-aquatic mammals, such as the true fur seal (*Otaria*), whose breeding habits are of great interest, the whalebone whale (*Balæna mysticetus*), the bottlenose (*Hyperoödon rostratus*). Of less commercial but equal zoological importance are the hooded seal (*Cystophora cristata*), the polar bear, the narwhal (*Monodon monoceros*), the white whale (*Delphinapterus leucus*), the Greenland seal (*Phoca grælandica*), and others. See F. Nansen's *First Crossing of Greenland* (1890); A. E. Norden-skiöld's *Voyage of the 'Vega' round Asia and Europe* (trans. by Leslie, 1881); A. E. Brehm's *From N. Pole to Equator* (trans. by Thomson,

1896); R. Collett's *Bird Life in Arctic Norway* (trans. by Cocks, 1894). A discussion of the general characters of Arctic plants will be found in J. C. Willis's *Flowering Plants and Ferns* (1897). For the special characters of Arctic mammals, reference should be made to Flower and Lydekker's *Mammals, Living and Extinct* (1891).

Arctic Ocean, one of the great water divisions of the globe, is for the most part enclosed between the n. coasts of Europe, Asia, and N. America. The only wide connection it has with the Atlantic runs over the ridge which links Iceland with Scotland by way of the Faroes, Shetlands, and Orkneys; but it has three other narrower openings—viz. Denmark Str., between Greenland and Iceland; Davis Str. (with Baffin Bay, Smith Sound, Lancaster Sound, and Jones Sound), between Greenland and British N. America (both of these connecting it with the Atlantic); and Bering Str., which unites it with the Pacific. The region immediately round the pole consists of deep water covered with rough and broken pack ice. At its periphery the Arctic is bordered by a tolerably broad continental shelf, above which the water is exceptionally shallow; at least this is the case along the n. of Europe and the n. of Siberia as far as 135° E. long. West of this point the depth of water on the continental shelf is generally between 50 and 80 fathoms; but in the Kara Sea it sinks to 400 fathoms or more, and between Novaya Zemlya and Franz Josef Land there exists a depression of 100 to 150 fathoms deep. There is also another depression between Norway and Bear I., measuring 240 fathoms. But east of 135° E. long. the depth, even on the line of continuation of the continental shelf, suddenly plunges down to 2,000 fathoms. Along the route which the *Fram*

(Nansen's vessel) drifted in 1893-6 the soundings exceeded 1,800 fathoms, and often 2,000 fathoms, from 79° N. lat. and 138° E. long. to near Spitzbergen. West of Spitzbergen the greatest ascertained depth is 1,720 fathoms (Nathorst expedition, 1898). And, so far, the absolutely greatest depth sounded in the Arctic is 2,100 fathoms, in 81° N. and 130° E.; or 2,650 fathoms, if we accept the sounding of the *Sofia* made in 1868. The various subdivisions of the Arctic Ocean—Kara Sea, Barents Sea, White Sea, Greenland Sea, Norwegian Sea, Baffin Bay, Davis Strait, and Bering Strait—are treated under separate articles. The area of the Arctic Ocean is estimated at 5,908,000 sq. m., and it is computed to receive the drainage of 8,614,000 sq. m. In the Polar basin the temperature of the surface water is generally at 29.2° —about the freezing-point of salt water. At about 110 fathoms it suddenly increases to 33° - 33.5° . But the temperature (and with it the salinity) ranges highest between 120 and 350 fathoms—viz. 35° to 39.9° . Underneath this warm stratum—which is no doubt due to the diffusion of the Gulf Stream—there comes a second cold layer, the middle of which lies at about 500 fathoms, where Nansen found the temperature to be 31.9° . But from 1,000 fathoms to the bottom there is a pretty uniform temperature of 33.1° to 33.4° . The lowest air temperature recorded in the *Fram* expedition was -52.5° , with which it is interesting to compare the lowest land temperature of -90° F. at Verkhoyansk in Siberia. In the higher latitudes of the Polar basin the winter seems to be characterized by a clear atmosphere and absence of wind, though towards its outer margin (Franz Josef Land, Spitzbergen, Greenland) boisterous gales prevail, and the temperature is not so

low. Normally, the ice-pack seldom exceeds from 7 to 13 ft. in thickness. It is neither unchangeably fixed nor unalterably solid, but, in the summer at any rate, is in almost unceasing motion. Not only does it drift bodily from the middle of the N. coast of Siberia in a northerly curve westwards towards the N.E. shoulder of Greenland, but it is locally subject to continuous disturbance, being thrust up into hummocks by pressure from below, and alternately split asunder and again driven together. In summer, outside the edge of the permanent ice-pack, there is in many places a permanent layer of fresh water, sometimes 5 to 6 ft. in depth, which has resulted from the melting of the ice-pack itself, and from the outflow of the great Siberian rivers. In addition to the movements just mentioned, there is a never-ceasing circulation between the waters of the Arctic and the waters of the Atlantic, in that the warm surface water of the latter flows up between Greenland and Norway, and then, becoming chilled on contact with the cold Arctic water and ice, sinks towards the bottom, and finally flows back southwards as a cold current, chiefly along the E. side of Greenland and down Davis Str., carrying with it the icebergs which are so often a menace to vessels navigating the Atlantic. But this circulation, thus generally outlined, is locally much complicated by the Gulf Stream, by the winds, and by the submarine ridges and trough-like depressions which intervene between the continental shelf and the islands, and amongst the islands themselves. Animal life is fairly abundant in the Arctic regions. (See ARCTIC LIFE.) The sun remains permanently above the horizon about 160 days, and for a corresponding period remains permanently below it—this is, of

course, in high latitudes. See Dr. Nansen's *Farthest North* (2 vols. 1897), and *Scientific Results of the Nansen Expedition* (vol. i. 1900); and recent works cited under ARCTIC EXPLORATION.

Arctinus OF MILETUS (fl. c. 750 B.C.), one of the 'cyclic' poets, who completed the cycle of epic stories begun by Homer. Only fragments of his poems survive, but he is said to have written two epics—the *Æthiopis*, continuing the story of the *Iliad*, and the *Sack of Troy*. His fragments are collected in Kinkel's *Epicorum Græcorum Fragmenta* (1878), also in Monro's Oxford Text of *Homer* (1896).

Arcturus, a Boötis, the brightest star in the northern hemisphere, its photometric magnitude being 0.07. It is first mentioned by Hesiod, who selected the acronychal rising of Arcturus (the latest visible after sunset) as the signal for the pruning of the vines; and his fixing of the occurrence at sixty days after the winter solstice gives 730 B.C. as the approximate date of composition of the *Works and Days*. Arcturus had a stormy reputation. The spectrum of the star is of the solar type, and its rays have a reddish tinge. The minute parallax of 0".02 indicates for it a light-power 2,000 times greater than that of the sun; and, taken in conjunction with its proper motion of 2.3" annually, shows it to have an actual velocity in space of at least 260 m. a second. The heat received from it was measured with a sensitive radiometer by Professor Nichols at the Yerkes Observatory in 1898. It is approaching the sun with a velocity of 4 m. a second.

Arcueil, vil., Seine dep., France, 3 m. s. of Paris. A holiday resort, and noted for the ruins of a Roman aqueduct over the valley of the Seine, which was built to supply the baths of Julian at Paris. Pop. 9,000.

Ardagh, SIR JOHN CHARLES (1840-1907) soldier and diplomatist; took part in the congresses of Constantinople (1876 and 1881) and Berlin (1878 and 1880), in the Bulgarian boundary commission (1879); was commissioner for the delimitation of the Turco-Greek frontier (1881); member of the Chile-Argentina arbitration tribunal, and of the S. African claims commission (1901); member of Permanent International Court of Arbitration at the Hague; and government director of the Suez Canal (1903). In his military capacity he took part in the Sudan expeditions of 1884-6, being present at the actions of Tell-el-Kebir, Teb, Tamai, and Giniss; was director of the school of military engineering, Chatham (1894-6); and director of military intelligence (1896-1901). See *Life* by his wife (1909).

Ardahan, fort. tn., Transcaucasia, Russia, on river Kura, 44 m. N.N.W. of Kars. Ceded by Turkey in 1878.

Ardalan, or ARDELAN, prov. (6,000 sq. m.), forming the E. div. of Kurdistan, Persia. It is divided into two districts—Ardalan in the N., with Senna as cap. of district and of Kurdistan; and Kermanshah in the S., with cap. of same name. The surface is mostly mountainous, with fertile valleys and grass plains, except in the E., where there is much waste land.

Ardashir, founder of the Sasanian dynasty of Persia, wrested the crown from Artabanus, the last of the Arsacid (Parthian) line, in a battle fought by appointment on the plain of Hormizjan (227 or 224). He had first made himself master of Istakhr (Persepolis), and built his power upon the influence of the ancient Zoroastrian faith. His career of conquest was checked by the Romans in 233. Ardashir died in 241.

Ardea, decayed tn., prov. Rome, Italy, on an isolated rocky plateau

in the Campagna, 12 m. N.W. of Anzio; was abandoned about the beginning of the Christian era because of malaria.

Ardebil, ARDABIL, or ARDABEEL, tn., prov. Azerbaijan, Persia, 110 m. E. of Tabriz; trading centre on the route to port of Astara on the Caspian Sea. The shrine of Sheikh Sufi is annually visited by numerous pilgrims. Pop. 10,000 to 15,000.

Ardèche, mountainous and picturesque dep. (area, 2,136 sq. m.), S. France, on r. bk. of Rhone, its E. limit; is watered mainly by the swift-flowing Ardèche (length 60 m.) and its tributaries. Though mainly agricultural, iron, coal, lignite, zinc, and lead are plentiful, and much silk is produced. Cap. Privas. Pop. 347,000.

Ardee, mrkt. tn. and par., Co. Louth, Ireland, on the Dee, 10 m. S.W. by S. from Dundalk; has milling industries. Pop. 1,800.

Arden, FOREST OF, a former forest (patches of woodland rather than continuous forest) in Warwickshire, N. of the Avon (see Shakespeare's *As You Like It*, Act ii., in which, though the characters are French, the allusions to Robin Hood and the descriptions of scenery clearly indicate the English forest). Previous to the division of England into counties, the name was applied to a more extended tract reaching N. to the Trent and W. to the Severn.

Ardennes. (1.) Wooded mountain system, S.E. Belgium, between Meuse and Moselle; geologically connected with the hills which fence in the Rhine between Bonn and Bingen. The general elevation is about 1,800 ft. It consists mainly of barren moors, with densely-wooded (oaks and beeches) slopes and fertile river valleys. Large stalactite caves exist at Han and other places, and the region yields coal, iron, lead, antimony, copper, manganese, and clay. See Montagnac's *Les Ardennes* (1875);

Macquoid's *In the Ardennes* (1881). (2.) Department (area, 2,028 sq. m.), N. France, with only the N.W. portion in the Ardennes system; is crossed by the Meuse and the Aisne, these rivers being joined by a canal. The climate is continental, and dry and pleasant in autumn. The department is agricultural in the centre and south, pastoral in the east, with a renowned race of sheep, and industrial (iron and textiles) in the Meuse valley. Cap. Mézières; but its neighbour, Charleville, is twice as populous. Pop. 318,000. See Joanne's *Le Département des Ardennes* (1898).

Ardestan, or ARDISTAN, tn., Irak Adjemi prov., Persia, 80 m. N.E. of Ispahan. Pop. about 10,000.

Ardilaun, ARTHUR EDWARD GUINNESS, BARON (b. 1840), the head of the great brewing firm of Arthur Guinness and Co., who, after representing Dublin in the Conservative interest in 1868-9 and 1874-80, was raised to the peerage in 1880.

Arditi, LUIGI (1822-1903), musical composer and conductor; born at Crescentino in Piedmont; studied music at Milan, and became an expert violinist. In 1841 he produced his opera *I Briganti*, and made his début as an operatic conductor at Vercelli in 1843. He conducted in Milan, London, Vienna, Madrid, Constantinople, St. Petersburg, Havana, and the great cities of the United States (1846-56); and from 1858, when he settled in London, he was conductor at Her Majesty's Theatre. He is best known by his brilliant vocal compositions—*e.g.* *Il Bacio* and *L'Ardita*. See *My Reminiscences* (ed. by Baroness von Zedlitz, 1896).

Ardmore, tn. of the Chickasaw nation, Indian Territory, Oklahoma, U.S.A., about 95 m. N. by E. of Fort Worth, Texas; has cotton trade, and asphalt and coal mining interests. Pop. 8,500.

Ardnamurchan, par. (109,400 ac.), vil., and headland, Argyllshire, Scotland, 7 m. N.N.W. of Tobermory. Pop. 2,000. The headland is the most westerly point of the mainland of Great Britain.

Ardoch, par. (22,127 ac.) and vil., 7½ m. S. of Crieff, Perthshire. Site of a celebrated Roman camp, and of Lindum, an aboriginal British town. Pop. 900.

Ardoye, tn., West Flanders prov., Belgium, 6 m. W. by S. of Thiel; has brewing and weaving. Pop. 6,200.

Ardrishaig, coast vil., Loch Fyne, Argyllshire, Scotland, at S. end of Crinan Canal. Pop. 1,300.

Ardrossan, seapt. and wat.-pl., Ayrshire, Scotland, 1 m. W.N.W. of Saltcoats. Industries are ship-building, engineering, iron works, sawmills, and timber yards. Exports, coal and pig iron. Castle Craig Head was the site of a castle of the Montgomeries, which was captured by Wallace and demolished by Cromwell. Pop. 6,000.

Ardsley, urb. dist., W. Riding, Yorkshire, England, 2 m. E. of Barnsley; has collieries and glass works. Pop. 6,200.

Ardstraw, par. and vil., co. Tyrone, Ireland, 3 m. N.W. of Newton-Stewart; has freestone, lime, and clay-slate quarries. Pop. 8,500.

Ardtree, or ARTREA, par. in cos. of Tyrone and Londonderry, Ireland, 4 m. S.E. of Magherafelt. Pop. 5,800.

Are (Lat. *area*), in the French metric system, is the unit of superficial measurement, being 100 sq. metres, equivalent to 119.6 sq. yds. The hectare (100 ares) = 2.47 imperial acres.

Areca. See BETEL-NUT PALM.

Arecibo. (1.) Tn., N. coast, Porto Rico, W. Indies, cap. of dep. of same name, 40 m. W. of San Juan, at outlet of Rio Grande de Arecibo; exports coffee and sugar. Pop. 10,000. (2.) Dep. N.

coast of Porto Rico, having Aquadilla on the w. and Bayamon on the e. Area, 620 sq. m.; pop. 160,000.

Arenaceous Rocks, sedimentary rocks consisting chiefly of sand or gravel. See SANDSTONE.

Arenaria, or SANDWORT, a large genus of rock and alpine plants of wide distribution. *A. balearica*, *A. montana*, and *A. norvegica* are useful in the rock garden.

Arenberg, formerly a part of the bishopric of Münster, in Westphalia, Germany; made a duchy in 1826, but incorporated with Prussia—i.e. Prussian Hanover—in 1866. It lay on both sides of the middle course of the Ems, and had an area of 847 sq. m. Its capital was Meppen.

Arendal, or ARNDAL, tn., Nedenäs co., Norway, on s. coast, 36 m. N.E. of Christiansand; timber and carrying trade and iron mines. Pop. 11,000.

Arends, LEOPOLD (1817–82), a Russian, resident in Berlin; devised a system of shorthand extensively used on the Continent. See his *Vollständige Leitfaden* (1860; latest ed. 1896); Kaselitz's *Kritische Würdigung der deutschen Kurzschriftsysteme* (2nd ed. 1890); Wendtland's *Leopold Arends* (1883).

Arenicola. See LUGWORM.

Arenig Rocks, the lowest subdivision of the Lower Silurian formation, so called from the Arenig Mt. in N. Wales; often hundreds of feet thick, and consist mostly of black and gray shales and grits. Slates are quarried from this series in Wales. See Ramsay's *Geol. of N. Wales* (1866) and Fernside, in *Q.J.G.S.*, vol. lxi.

Arensky, ANTON STEPHANOVITCH (1861–1906), Russian musical composer; born at Novgorod; professor at the Moscow Conservatoire (1883–95), and director of the imperial choir at St. Petersburg; author of three operas—*Un Songe sur le Volga* (1892), *Raphael*

(1894), and *Nal et Damayanti* (1899)—symphonies, etc. His trio (Op. 32) and quintet (Op. 51) for pianoforte and strings are well known. In his *Attempts at some Forgotten Rhythms* (1894) he revived some interesting ancient forms.

Areometer. See HYDROMETER.

Areopagus, 'Hill of Ares (Mars),' a hill in Athens, w. of the Acropolis; on its northern slope stood the temple of Ares. It gave its name to the council of the Areopagus, which met there. This council represents the 'council of elders' possessed by every Aryan nation. Until the establishment of the democracy, it constituted the government of Athens; but Solon's council of four hundred, and Clisthenes's of five hundred, took away some of its powers, which were still further reduced (460 B.C.) by Ephialtes and Pericles. Its composition in earlier days is unknown; but from 600 B.C. it consisted of ex-archons.

Arequipa. (1.) Coast dep., S. Peru, with an area of 22,000 sq. m. and a pop. of 230,000. (2.) Tn., Peru, the second in the republic, 500 m. S.E. of Lima, stands in the former bed of a lake, watered by the Chile R. The town, which was founded by Francisco Pizarro in 1540, has suffered severely from earthquakes, as in 1868. Besides the cathedral, there are large churches, monasteries, and convents, and a university. Near the town are hot mineral springs. Arequipa sends to Mollendo (107 m. by rail) sheep, alpaca and vicuna wool, borate of lime, ores, etc., for export. Jewellery is extensively manufactured, and gold and silver are mined in the vicinity. Alt. 7,850 ft. Pop. 40,000. Harvard College (U.S.A.) opened here (1889) a branch astronomical observatory. See EL MISTI.

Ares, the Greek god of war, whom the Romans identified with

their god Mars, is represented as the son of Zeus and Hera. He is represented by Homer as not on equal terms with the other Olympians, and is somewhat of a swashbuckler and ruffian. He is constantly in very undignified positions—as when Athene and Diomedes drive him from the field (*Iliad*, v.), and the pain of his wounds makes him roar as loud as 9,000 or 10,000 warriors together, and Zeus refuses him sympathy; and, again, in his amour with Aphrodite (*Odyssey*, viii.), Sophocles calls him “the god unhonoured amongst the gods divine” (*Æd. Tyr.*). His worship originally belonged to Thrace, where Dionysos was his younger rival. This “barbarous origin” lowered the estimate of him in Greece.

Aretæus (c. 100 A.D.), a Greek physician who is ranked next after Hippocrates as a diagnoser of diseases; born in Cappadocia; practised in Rome, and left two important medical works, written in elegant and concise Ionic Greek. See ed. by J. Wigan (1723), Adams (Gr. and Eng., 1856), Eng. trans. by T. F. Reynolds (1837), and Locher's *Aretæus aus Kappadokien* (Gr. and Ger., 1847).

Arethusa, one of the Nereids, and nymph of the famous fountain of the same name in the island of Ortygia, near Syracuse. See ALPHEUS.

Aretino, PIETRO (1492–1557), Italian poet and satirist; born at Arezzo, whence he was banished on account of his lampoon against indulgences; worked as a book-binder at Perugia; visited Rome (1517), where he was favourably received by Pope Leo x., whose patronage, however, he lost by the publication of obscene sonnets as letterpress to drawings by Julio Romano. He then became a client of Giovanni de' Medici, and received favours from Francis I. of France and Charles v. of Germany.

His later days were spent at Venice. Although his life was licentious and venal, and his writings impudent, Pietro enjoyed extraordinary popularity for the wit of his verses and plays. He wrote dialogues (*Ragionamenti*, 1535–8), five prose comedies (*Il Marescalco*, 1533; *La Cortigiana*, 1534; *L'Ipocrito*, 1542; *La Talanta*, 1542; and *Il Filosofo*, 1546), a tragedy (*Orazia*, 1546), letters (6 vols. 1538–57), and sonnets, the last of which have been translated into French under the title of *Académie des Dames*. See *Lives* by Sinigaglia (1882), Schultheiss (1890), and Bertani (1902).

Arezzo. (1.) Prov. (area, 1,273 sq. m.), Italy, forming s.e. division of Tuscany, stretching across main chains of Central Apennines. Cereals, wine, fodder crops, olives, mulberries, etc., are grown, and woollens, hats, and leather are the chief industries. Pop. 285,000. (2.) Anc. *Arretium*, cap. of above and episc. see, 55 m. by rail s.e. of Florence, stands on the side of a hill overlooking the valley of the Chiana. It was one of the twelve confederate cities of the ancient Etruscans, and possesses several very interesting buildings of the 13th to the 15th century, chief among them being the Gothic cathedral, begun in 1277, and containing monumental tombs of Pope Gregory x., who died here in 1276, and of Tarlati, the warlike bishop of Arezzo (died 1327). Arezzo is the birthplace of the poet Petrarch (1304), the satirical writer Pietro Aretino (1492), Vasari (1513), the painter Spinello Aretino (c. 1330), the musician Guido Aretino (c. 1000), and the botanist Cesalpino (1519). Silk, cloth, leather, pottery, etc., are manufactured. Pop. 44,000.

Argæus (Turk. *Arjish-Dagh* or *Erjish-Dagh*), extinct volcano and loftiest mt. in Asia Minor, 10 m. s. of Kaisarieh, was active in the

time of Strabo and Claudian (1st to 4th cent.). Alt. over 13,000 ft.

Argall, SIR SAMUEL (c. 1580-1626), an English adventurer who went to Virginia in 1609, abducted (1612) Pocahontas, the daughter of the Indian chief Powhatan, and thus secured the liberty of several English captives. In 1613 he destroyed the French settlements of Mount Desert, St. Croix, and Port Royal, in Nova Scotia. He was deputy governor of Virginia (1617-19), and died when returning from an expedition against Cadiz (1625-26).

Argand Burner, invented by Argand of Geneva about 1782. Used in oil lamps, the wick rises through a hollow ring, so as to admit air to both surfaces of the flame, with the effect of greatly increasing the light and heat. Gas burners are also made on this principle, the gas rising through a hollow ring perforated with small holes. By means of a chimney the flame is steadied, and a draught created.

Argand Diagram. See COMPLEX NUMBER.

Argan Tree (*Argania sideroxylon*), a hard and durable evergreen tree of Morocco, from the nuts of which is extracted an edible oil resembling that of olives.

Argao, tn., E. coast, Cebu, Philippine Is., 35 m. S.W. by S. of Cebu. Produces hemp and sugar. Pop. 35,000.

Argaum, or ARGAON, tn. in Akola dist., Berar, India; contains 800 wells, hence its name 'city of wells.' The Nagpur army was defeated here by the British, under Wellesley, in 1803.

Argel, or ARGHEL (Syr.), a name given in Syria and the Levant to *Solenostemma argel* (nat. order Asclepiadaceæ), a plant whose leaves are used in Egypt for the adulteration of senna leaves, from which they are distinguishable by their leathery texture, downy surface, and the symmetry of their sides.

Argelander, FRIEDRICH WILHELM AUGUST (1799-1875), German astronomer, was born at Memel, and was the pupil and assistant of Bessel at Königsberg. From 1823 to 1827 he was director of the Abo Observatory, which was removed to Helsingfors about 1832. In 1837 he became professor of astronomy at Bonn, where he published an able celestial atlas, *Uranometria Nova*, in 1843. In continuation of Bessel's work, he determined the position of 22,000 stars, described in his *Astronomische Beobachtungen zu Bonn* (7 vols. 1846-75). Another important book was *Atlas d. nördlichen gestirnten Himmels* (1857-63; new ed. 1899).

Argens, JEAN BAPTISTE DE BOYER, MARQUIS D' (1704-71), French popular philosopher, born at Aix in Provence. After serving in the French embassy at Constantinople and in the army, he turned to Literature. His *Lettres Juives* (best ed. 1766), *Lettres Chinoises* (1739), and *La Philosophie du Bon Sens* (1744) won the patronage of Frederick the Great, who made him director of Berlin Art Academy. Wrote *Histoire de l'Esprit Humaine* (1765-8) and *Lettres et Mémoires* (1735). A selection of his works appeared in 24 vols. in 1763.

Argensola, BARTOLOMÉ LEONARDO (1565-1631), Spanish poet and historian; born at Barbastro. With his elder brother, Lupercio, he was the leader of the so-called Aragonese school of Spanish literature. He succeeded Lupercio as annalist of Aragon, and also wrote a *Hist. of the Conquest of the Moluccas* (1609). Although a canon of Saragossa, he penned numerous songs, satires, and sonnets. The poetical works of the two brothers, who were styled 'the Horaces of Spain,' were published first in Saragossa in 1634. See Mir's *B. L. de Argensola* (1891).

Argensola, LUPERCIO LEONARDO (1563-1613), Spanish poet and

historian, brother of the preceding. His genius and works, poetical and historical, were similar to those of his brother, and give him a high place in Spanish literature. He was secretary to the ex-Empress Maria of Austria at Madrid, chronicler of Aragon, and secretary of state to the viceroy of Naples. He wrote three dramas, *Isabela*, *Filis*, and *Alexandra*, the first two praised by the canon in *Don Quixote*; but he is best known for his lyric poems and sonnets. See De la Viñaza's ed. of his poems, entitled *Obras Sueltas* (1889).

Argenson, D', name of a distinguished French family of Touraine, of whom the most famous are: (1.) MARC RENÉ DE VOYER (1652-1721), chief of police in Paris (1697-1718), president of the council of finance (1718-20) in the time of Robert Law, with whom he secretly co-operated, but in favour of whom he was dismissed in 1720. (2.) RENÉ LOUIS VOYER, MARQUIS (1694-1757), son of Marc René, foreign secretary (1744-7); author of *Considérations sur le Gouvernement de la France* (1764), and useful *Mémoires* (9 vols., ed. Rathery, 1860-8). (3.) MARC PIERRE DE VOYER, COUNT (1696-1764), brother of René Louis; minister of war (1742-57). He laboured for the reorganization of the army, and founded (1751) the military school. The friend of Diderot, who dedicated the *Encyclopédie* to him, and of Voltaire, he incurred the enmity of Madame Pompadour, and was exiled, but returned to Paris at her death. (4.) MARC RENÉ DE VOYER (1771-1842), a wealthy aristocrat who in the revolution was Lafayette's aide-de-camp for a time.

Argent, in heraldry, is the metal silver, usually represented by white.

Argenta. (1.) Tn. in Emilia, Italy, in prov. of and 20 m. s.e. of Ferrara. Pop. (comm.) 20,000.

(2.) Tn., Pulaski co., Arkansas, U.S.A., on the Arkansas R., op-

posite Little Rock; trading centre in cotton and cotton-seed oil. Pop. 11,000.

Argentan, tn., dep. Orne, France, 27 m. by rail n. of Alençon; has manufactures of lace (*point d'Argentan*), linen, and gloves; contains an old castle (15th century). The historian Mézeray (1610) was born near here. Pop. 6,400.

Argentario, or ARGENTARO, MONTE, mt., Italy, prov. Grosseto, in the Tuscan Apennines, 37 m. n.w. of Civita Vecchia; alt. 2,050 ft. It forms a peninsula, connected with the mainland by two strips of land of recent formation. At the foot of the mountain are two little harbours, Porto Ercole and Porto San Stefano.

Argentera, PUNTA DELL', the highest summit (10,794 ft.) of the Maritime Alps, s.w. of Cuneo, in Piedmont.

Argenteuil, dist. tn. in dep. of Seine-et-Oise, France, on r. bk. of the Seine, 8 m. n.n.w. of Paris. Market gardening; also quarries, watchmaking, and wine industries. Pop. 20,000.

Argentièrre, COL D', an easy Alpine pass (6,545 ft.) leading from Barcelonnette, in the French valley of the Ubaye (an affluent of the Durance), to the Italian valley of the Stura, and so to Cuneo. Napoleon made a carriage road across it, but the pass was known to the Romans (remains found), though it only came into prominence when crossed by Francis I. of France and his army in 1515. Some have supposed that it was Hannibal's pass, but this was probably the Mont Genève.

Argentine, a city of Wyandotte co., Kansas, U.S.A., situated on Kansas R., 3 m. from Kansas city. Has smelting and refining works for gold, silver, copper, etc., grain elevators, and railway repairing works. Pop. 6,300.

Argentine Republic, the most progressive of S. American states,

and the second in size, extends for a distance of 2,300 m. from the frontier of Bolivia, on the N., to Staten I., Tierra del Fuego, in the S. In the N. the Puna de Atacama was divided with Bolivia in 1899 so that the larger and more valuable E. portion fell to the Argentine Republic. South of 41° S. lat., the dispute as to the boundary with Chile was submitted to King Edward VII. of England as arbitrator, and in 1902 he determined that the frontier should coincide for the most part with the watershed (this does not coincide with the main chain of the Cordillera).

The N. part of the republic slopes very gradually from the coast N.W. to the Bolivian basin, where the watershed between the affluents of the Paraguay R. and the headwaters of the Madeira lies only 800 or 900 ft. above sea-level. At a very recent geological period this country was the basin of a vast sea covering about 600,000 sq. m. On the S. it seems to have been bounded by the Archæan and Palæozoic sierras of Tandil, Ventana, etc., stretching across the province of Buenos Ayres from Cape Corrientes. On the W. the Sierra de Cordoba rose as islands above the sea, and the Salina Grande was a fjord opening into it. Into this great basin the rivers carried their silt. The S. extremity of the republic, Patagonia, is a plateau of Tertiary sandstone, interrupted here and there by old eruptive rocks and Archæan schists, which slopes up W. to the watershed, where Cretaceous rocks are exposed. It is intersected by deep depressions, many of them drained by the existing rivers flowing to the Atlantic. Along the watershed, a succession of elevations 6,000 to 7,000 ft. high, lies a series of lakes, some of which now drain to the Pacific, but occasionally, when the water is high, send part of their overflow to the Atlantic.

The land has risen even within historic times, and the lakes, to a great extent excavated by glacial action, are drying up.

From the great lake Nahuelhuapi (41° S. lat.) to 34° S. lat. the Andes consist of a single chain. Farther N. a succession of sierras lies to the E. of the main chain, the chief being the Uspallata, Huerta, and Famatina, and the prolongation of the Cordillera Real of Bolivia, with summits rising to 19,000 ft. Near the S. extremity of this region are found the loftiest peaks of the main Cordillera—*e.g.* Aconcagua (in which the American continent culminates at a height of 23,080 ft.), the extinct volcano Tupungato, and Maipu.

The largest hydrographic basin is that of the Parana and its tributaries. Many rivers lose themselves in the swamps and sands of the pampas. Of the rivers of Patagonia, the Negro is the most important for navigation.

Several lakes are scattered over the country; the finest are those in the W. of Patagonia—the beautiful Nahuelhuapi (2,100 ft. above sea-level, and 200 sq. m. in area), the Buenos Ayres (75 m. long and 558 ft. above the sea), and others.

The mean temperature in the central part of the republic is not much higher than that of S. Europe, and the extremes are not excessive. The mean temperature at Buenos Ayres (63° F.) is nearly the same as at Cadiz. In the N. and midland provinces it is higher—*e.g.* 71° at Corrientes, and 67° at Tucuman. Mendoza, near the Andes, at an elevation of 2,500 ft., has a mean temperature of only 61°. At Rawson, on the Chubut, the mean temperature is 56°, and in S. Patagonia the climate is cold. The rainfall—34 in. at Buenos Ayres and 46 in. at Rosario—diminishes towards the Andes, being only 13 in. at Rioja and 3 in. at San Juan. The prevailing wind is the S.E. The *pampero*, from the

s.w., is cold and invigorating, the N. wind relaxing and unhealthy.

A large part of the lands of the republic (about 45 per cent.) is classed as waste. West of Cordoba, and also in Patagonia, the rainfall is often too small to produce much vegetation. Irrigation, however, will in time convert a considerable proportion of these lands into fertile fields. The chief industry was originally stock-raising on the grassy plains (*pampas*) of Santa Fé and Buenos Ayres. The number of sheep has considerably increased of late years, the extreme s. having been found highly favourable to that industry.

The country is well suited for agriculture, but there is always considerable risk from drought. Wheat, maize, and linseed—*i.e.* flaxseed are grown, especially in Buenos Ayres and Santa Fé, as well as at the Welsh colonies on the Chubut. Wine comes principally from the w. provinces, Mendoza, San Juan, and La Rioja. Tucuman produces the most sugar, and Corrientes ranks first as a tobacco district. Lucerne (*alfalfa*) is one of the great crops, and is grown in almost all the provinces. Good cotton is grown in the N. provinces.

Minerals, including gold, silver, copper, lead, antimony, and petroleum, are widely distributed in the w. provinces. La Rioja, Catamarca, and Salta are especially rich in copper. Good coal is found at San Rafael in Mendoza, and superior lignite in Tierra del Fuego. The mining industry is at present little developed. Railways, with an aggregate length (1909) of 16,606 m., radiate from Buenos Ayres N., N.W., S.W., and W. to Mendoza, whence a line is continued over the Andes, which are pierced by a tunnel 2 m. in length, on to Valparaiso. There are 400 m. of extensions now (1910) under construction, and the Sen-

ate has authorized (Sept. 1910) the construction of another Trans-Andine railway connecting the northern part of Argentina with Chile.

The most extensive forests are situated in Misiones, El Chaco, and Formosa. Misiones yields a quantity of valuable fibres, and the *yerba-maté*, or Paraguay tea, as well as excellent timber for building and cabinet work and dyewoods. The export of *Quebracho colorado*, a hard-wood used in Europe for tanning, is rapidly increasing. Along the foot of the Andes the woods consist chiefly of Winter's bark, *Fitzroya patagonica*, and *Libocedrus*.

The fauna is rapidly vanishing. The puma and jaguar are still found in the less-populated districts of the Chaco and Patagonia. The viscacha is becoming scarce; and armadillos, esteemed a delicate dish, are killed in large numbers. The huemul (*Cervus chilensis*), the guanaco, and the rhea, or American ostrich, roam over the Patagonian plateaus. The peccary and anta, a species of tapir, are confined to the N. The Patagonian hare, weighing 25 lbs., and a weasel with a pouch for its young, are peculiar. Birds are more numerous than mammals. They include the condor of the Andes and other birds of prey, humming-birds, game-birds, and a large variety of water-fowl. The African or plume-bearing ostrich has been introduced, and 50,000 lbs. of plumes are now exported annually.

The government is a federal republic, with Buenos Ayres as its capital. The federal assembly is composed of two chambers—a Senate of 30 members, and a House of Deputies (120) elected by the city of Buenos Ayres and the 14 provinces (Buenos Ayres, Entre Rios, Corrientes, Santa Fé, Cordoba, San Luis, Santiago del Estero, Tucuman, Mendoza, San Juan, La Rioja, Catamarca, Salta,

and Jujuy), each of which manages its own internal affairs. A president and vice-president are elected for a term of six years. The sparsely-inhabited parts of the country are divided into 10 *gubernaciones* or territories—Formosa, El Chaco, Misiones, Los Andes, and Pampa, N. of the Colorado; Neuquen, Rio Negro, Chubut, Santa Cruz, and Tierra del Fuego, to the s.—which are administered by governors appointed every three years by the executive, with the approval of the Senate. Roman Catholicism is the state religion, and the hierarchy of the church consists of the archbishop of Buenos Ayres and the bishops of Cordoba, Mendoza, Parana, Cuyo (residing at San Juan), and Salta. Other sects may freely exercise their religion. An admirable system of free and compulsory education has been introduced, but more than one-half of the population over six years of age is illiterate. There are universities at Buenos Ayres, Cordoba, La Plata, Santa Fé, and Parana, and a well-equipped industrial school at Buenos Ayres.

The area of the Argentine Republic is 1,135,840 sq. m., and the estimated population in 1910 was close on 7,000,000, giving an average of 6.1 to the sq. m. Argentines—*i.e.* persons born in the country, of whatever nationality their parents may be—constitute three-fourths of the whole population. The majority of these are of Spanish extraction. The remaining fourth are made up of immigrants, Italians accounting for about 850,000, and Spaniards for about 430,000. The principal Indian races are the Guaranis, in the E.; the Quichuas, in the N. and centre; and the Araucanians and Patagonians, in the s. In El Chaco live the Tobas, Guaycurus, and Chiriguanos, the last of whom have attained to a remarkable degree of civilization.

In Patagonia the natives are rapidly dying out. The Tehuelches, in the extreme south, trade with Europeans, and to them are probably akin the Onas of Tierra del Fuego. The Yahgans of Beagle Channel are an undersized race of low intelligence.

In 1908 the declared value of imports was £54,594,547, and of exports £73,201,068. The chief exports are hides, wool, meat, and other animal products, wheat, maize, and linseed. The country ranks first in the export of linseed and frozen meat, second in wheat and maize. Great Britain supplies from 36 per cent. of the imports, and receives about 22 per cent. of the exports.

History.—Juan Diaz de Solis, a Spaniard, sailed up the estuary of the Rio Plata in 1516, and claimed the surrounding country for the king of Spain. In 1535 the site of Buenos Ayres was occupied; but no permanent settlement was established until after 1580, when Spanish rule began to have the support of other towns which were being founded. The settlements continued to be under the administration of the viceroy of Peru until 1788, when a new viceroyalty, with Buenos Ayres as the centre, was formed. In 1810 the general S. American revolt against Spain began, and in 1816 the Republic of the United Provinces of the Rio de la Plata was founded. From the turbulence of the next twenty years there issued the dictatorship of Juan Manuel de Rosas from 1835 to 1852. After his defeat by the forces of a coalition a new constitution was declared in 1853. The uprisings and revolutions of the next twenty years were typical of S. American states, but did not prevent material prosperity. In 1881 the Argentine Republic acquired by treaty with Chile a small part of Tierra del Fuego and the greater part of Patagonia. Reckless

finance and official extravagance forced President Colman to resign in 1890, and it was several years before the country recovered from the financial crisis, a notable feature of which was the embarrassment of Baring Brothers, the London bankers. Agriculture and stock raising have restored the Argentine Republic to its present flourishing condition. Though friction between the executive and legislative departments occasionally occurs, the stability of constitutional government is distinctly increasing. Arbitration treaties were made with Italy in 1907 and with Brazil in 1908. Discussion of the wisdom of restricting immigration is also increasing. See Turner's *Argentina and the Argentines* (1892); Child's *The Spanish American Republics* (1891); W. O. Campbell's *Through Patagonia* (1901); H. H. Pritchard's *Through the Heart of Patagonia* (1902); Mulhall's *Handbook of the River Plate Republics* (6th ed. 1893); Davis's *Climate of the Argentine Republic* (1903); Koebel's *Argentina Past and Present* (1910); Hirst's *Argentina* (1910); and Pennington's *The Argentine Republic* (1910).

Argenton-sur-Creuse, tn., dep. Indre, France, on the Creuse R., 55 m. E.S.E. of Châtelerault. Lace, linen, and gloves are manufactured. Pop. 6,300.

Argile Plastique (Fr. 'plastic clay'), a series of beds of clay found in the Tertiary basin of Paris, used for the manufacture of pottery, and belonging to the Lower Eocene. They correspond to the Woolwich and Reading beds of the London basin.

Argillaceous Rocks, sedimentary aqueous rocks in which clay is the chief ingredient. See SHALES, SLATES, MARL, CLAY, PIPECLAY, and FULLER'S EARTH.

Argo, the largest of Ptolemy's fifteen southern constellations, lies east of Canis Major and Columba.

The Greeks and Romans saw in it the ship of Jason; the Hindus venerated it as a solar, the Egyptians as a lunar, bark—the last-named people holding, further, that by means of it Isis and Osiris had surveyed the Deluge; and in Europe it still figured as the ark in the 17th century. The unwieldy size of the asterism led to so much confusion in the nomenclature of its component stars that Sir John Herschel recommended its partition into Carina, 'the keel;' Puppis, 'the poop;' Vela, 'the sails;' and Malus, 'the mast;' and the arrangement has become prevalent, save that, for Malus, Lacaille's Pyxis, 'the compass,' is sometimes substituted. One of the structures forming the great 'Keyhole' nebula (N.G.C. 3372), so called from the shape of one of its characteristic dark openings, seems, from a comparison of Sir John Herschel's drawing with Sir David Gill's photograph, to have lost, since 1837, nearly all its light. Close to the 'Keyhole,' the extraordinary variable η Carinae outshone Canopus in 1843, then rapidly declined, and is now stationary at 7.5 magnitude. It shows the spectrum of coupled dark and bright rays belonging to most temporary stars. A still finer spectral display is made by the brilliant Wolf-Rayet star, γ Velorum, some of the constituent lines in which have been identified through Professor Pickering's discovery of a second hydrogen series, represented by absorption in spectrographs of ζ Puppis. α Carinae and κ Velorum are spectroscopic binaries revolving in periods of 6.7 and 116.6 days respectively. The brief blaze of Nova Carinae in April 1895 would probably have escaped detection but for Mrs. Fleming's examination of the Arequipa negatives. Another Nova appeared in Vela in 1905. The lustrous section of the Milky Way in Argo is emblazoned with

several fine clusters, notably Messier 46, which includes the annular nebula N.G.C. 2438, and Messier 93, described by Smyth as 'of a starfish shape.' Both are situated in Puppis.

Argol (*crude tartar*), a hard crystalline deposit in the vats in which wine is fermented, and in bottles of wine, where it is termed 'crust,' is an impure bitartrate of potash, or 'cream of tartar.' The salt is present in grape juice, but being insoluble in alcohol, and sparingly so in water, is precipitated as fermentation proceeds. Tartaric acid, cream of tartar, Rochelle salts, and tartar emetic are prepared from the substance.

Argon (Gr. 'inactive'), A. 39.9, a gas existing in the atmosphere in the proportion of about 8 per cent., the presence of which was first suspected by Cavendish in 1785, but attracted no further notice till 1894, when Lord Rayleigh and Sir William Ramsay announced its discovery, calling it argon on account of its chemical inactivity. Lord Rayleigh found that nitrogen obtained from the air always gives a higher density than nitrogen prepared from chemical compounds, and Ramsay suggested that this was due to the presence in atmospheric nitrogen of a heavier gas. By passing atmospheric nitrogen through heated tubes which contained metallic magnesium, the nitrogen was fixed, and a residual gas was obtained; the same gas was afterwards obtained by other methods. Argon is nearly one and a half times heavier than air; it cannot be made to combine with any other element; it is more soluble in water than nitrogen or oxygen; it liquefies at -186° c., and solidifies at -190° c.; and is best recognized by the characteristic lines in the spectrum. See Ramsay's *Gases of the Atmosphere* (2nd ed. 1902), and *Position of Argon and Helium among the Elements* (1896).

Argonaut, or PAPER SAILOR, a name given to cuttles belonging to the genus *Argonauta*. One species, *A. argo*, lives in the Mediterranean, and is often called the paper nautilus. Its peculiarity is the presence—in the female only—of a thin translucent shell, used as a shelter for the eggs, and embraced by two of the arms.

Argonautæ, or ARGONAUTS, sailors of the *Argo*, who voyaged to *Æa* (afterwards called Colchis) to win the golden fleece. According to the legend, Pelias was king of Iolcos in Thessaly, having ousted his half-brother *Æson*; and to rid himself of *Æson*'s son Jason he persuaded him to fetch the golden fleece, which hung on an oak tree in the grove of Ares in Colchis, guarded day and night by a dragon. Jason agreed to go, and obtained Argus to build the ship *Argo*, sometimes represented as the first ship to venture on the deep. It had fifty oars, and its crew contained all the famous heroes of the day, particularly Jason himself, Castor and Pollux, Zetes and Calais (sons of Boreas), Orpheus, Hercules, Tydeus, Theseus, and Nestor. According to Herodotus, Jason made a preliminary voyage round the Peloponnesus, and was driven ashore in Libya. The final start was from Aphetæ, in Thessaly. On the way they landed at Lemnos, at Cyzicus in Mysia (where Hercules was left behind to seek for Hylas), and in the country of the Bebryces, whose king was defeated by Pollux in a boxing match; they sailed through the Symplegades—rocks which dashed together—but escaped with slight injury to the ship's stern, and ever afterwards the rocks stood fast. When they arrived at the mouth of the river Phasis in Colchis, the king, *Æetes*, promised to give up the fleece if Jason could harness to a plough two fire-breathing oxen, sow the field thus ploughed with dragon's

teeth which should yield a crop of armed men, and slay the men. But Medea, his daughter, who loved Jason, assisted him by magic to perform the task; and Jason, after securing the fleece, sailed away by night, accompanied by Medea and her young brother Absyrtus. Æetes pursued them, but Medea killed her brother and scattered his limbs, so that Æetes was delayed while collecting them for burial. These adventures took place in the Black Sea. We next find the wanderers at the mouth of the Eridanus (Po): it was evidently supposed that the Adriatic could be reached from the Black Sea by a passage north of Greece. After a storm the vessel spoke, declaring that the Argonauts must visit Circe in Ausonia, in order to obtain purification for the murder of Absyrtus. Thence they sailed southward, passing the Sirens while Orpheus sang to drown their enticing chants. Then they passed between Scylla and Charybdis (Straits of Messina) to the land of the Phæacians (Corcyra). Thence, after visiting Crete and Ægina, they returned to Iolcos. For the later story, see JASON, MEDEA, and PELIAS. Cf. Pindar's longest ode, the 4th Pythian; Euripides's *Medea*; and Apollonius Rhodius's *Argonautica*. See also Kingsley's *Heroes* (1856).

Argos, ARGOLIS, ARGIA, or ARGOLICE, dist. and tn. of anc. Greece, lying around the Argolic Gulf, bounded w. by the Arcadian Mts., s. by Laconia, and e. by the territories of Trœzen and Epidaurus. In early days it became the predominant state in the Peloponnesus, but early in the 6th century B.C. Sparta reduced it to a secondary place. The state, however, retained its independence until the Roman conquest (146 B.C.). The town Argos, with its citadel Larissa, lies on a plain w. of the Inachus R., 7 m. N.W.

of Nauplia, and was noted for the worship of Hera (Juno), whose temple, the Heræum, lay between it and Mycenæ. Its pop. is 10,000. Argolis forms one of the 26 nomarchies of modern Greece (area, 1,104 sq. m.; pop. 82,000).

Argostoli, seapt. on gulf of same name, cap. of Cephalonia, in the Ionian Is., Greece; seat of a Greek bishop; chief port in the Ionian Is., and affording good anchorage; exports currants and wine. Pop. 10,000.

Argot. See SLANG.

Arguelles, AUGUSTIN (1778-1844), Spanish statesman and orator. He assisted in producing the liberal constitution of 1812; was imprisoned (1814-20) on the restoration of Ferdinand VII.; and was in exile (1823-32). Afterwards he became a leader of the Moderates, and guardian (1841) to Queen Isabella. See *Life* by San Miguel (1851).

Argument, a reason offered for or against a proposition, opinion, etc.; a debate or disputation. Certain types of argument have received special names—*e.g.* (1) the *argumentum a fortiori*, an argument from the truth of a more general or difficult proposition to the truth of a related proposition of less generality or difficulty; (2) the *argumentum ad hominem*, an argument applied to the particular man one is addressing, based on his principles or conduct, his prepossessions or prejudices; (3) the *argumentum ad rem*, an argument drawn from the nature of the subject-matter; (4) the *argumentum ad populum*, an argument based on prevailing opinions or sentiments; (5) the *argumentum ad verecundiam*, an appeal to an opponent's unwillingness to contradict the opinions of eminent authority; (6) the *argumentum e consensu gentium*, an argument from the general acceptance of a proposition to its truth; and (7) Addison's *argumentum*

baculinum, 'which is very well expressed in our English words *club law*. When they were not able to confute their antagonist, they knocked him down' (*Spectator*, No. 239).

Argun, riv., Siberia, joins the Shilka to form the Amur; rises in the Great Kinghan Mts., flows N., and drains the E. of Transbaikalia, passing through Nerchinsk, and forming the frontier between Siberia and China. Length, 440 m.

Argus, son of Arestor. As he had a hundred eyes, only two of which were closed at one time, Juno set him to watch Io, whom Jupiter had changed into a heifer; but Mercury, who was sent to carry her off, managed to surprise and kill Argus, whereupon Juno transferred his eyes to the tail of a peacock, her favourite bird.

Argus Pheasant (*Phasianus argus*), a native of the Indo-Malay region, so called because certain of the wing and tail feathers in the male bear a series of ocellated spots, these feathers being much elongated.

Argyll. The first earl of this title, the second Lord Campbell (d. 1493), was descended from an Anglo-Norman family. He obtained the estates of Lorne by marriage; and the family influence was further increased by Archibald, second earl, who shared with the Earl of Huntly the lordship of the Isles, and was killed at Flodden; by Colin, third earl (d. 1530); and by Archibald, fourth earl (d. 1558). Archibald, fifth earl (1530-73), headed the Lords of the Congregation in their successful efforts to thwart the policy of the queen regent; was involved in the murder of Darnley; and intrigued to deliver Mary from prison. Under the regency of Morton he was, however, made lord chancellor. His half-brother Colin, sixth earl (d. 1584), headed the conspiracy in 1578 against the regent Morton; was one of the jury by whom

Morton was condemned in 1581; and was implicated in the Raid of Ruthven (1582) and in the plot to release James (1583). Archibald, seventh earl (?1576-1638), shares with Huntly the discredit of almost extirpating the Macgregors in 1608. To escape his creditors he had to leave the country. Before leaving England he had ceded his estates to his son Archibald (1598-1661), afterwards eighth earl, who was created marquis in 1641. This earl, depicted in Scott's *Legend of Montrose*, supported the Covenanters; and although, in 1641, he was created marquis, he nevertheless bore arms against Charles I., and in 1644 was defeated by Montrose. He took up the cause of Charles II. against Cromwell in 1651; but at the restoration he was called to account by Charles II. for submission to Cromwell's usurpation, and was executed at the Cross of Edinburgh in 1661. The fate of his son Archibald, ninth earl (d. 1685), was equally tragic. His support of the Highland rising in favour of Charles II. in 1654 led to his condemnation; but he was released in 1663, and restored to his estates and titles as earl. He suppressed the risings of the Covenanters in 1665 and following years, though always advising gentler measures; and for resisting the Test Act of 1681 he was found guilty of treason. Escaping from prison, he went over to Holland, whence in 1685 he returned to Scotland, and associated himself with the Monmouth rebellion, when he was taken prisoner and beheaded at Edinburgh. (See *Life*, by J. Willcock, 1908). The restoration by William of Orange of Archibald, tenth earl and afterwards duke (d. 1703), to his estates, was one of the causes of the rising in the Highlands under Dundee in 1689. Argyll shares with Dalrymple the responsibility for the massacre of Glencoe. He

was created duke in 1701. His eldest son, John, second duke (1678-1743), was created a peer of England for his services in supporting the Union, and served under Marlborough. He took a leading part in promoting the accession of George I.; was appointed commander-in-chief in Scotland, and led the Royalist troops against the Jacobites at Sheriffmuir. In 1718 he was created Duke of Greenwich. He figures in *The Heart of Midlothian*. He was succeeded by his brother Archibald, third duke (1682-1761), who became keeper of the Great Seal and main counsellor of the government in its dealings with Scotland. George Douglas, eighth duke (1823-1900), second son of the seventh duke, was a distinguished orator and politician, and an able writer on ecclesiastical matters, on geology, and on economics. From 1853 he was a member of most Liberal governments, successively Lord Privy Seal, Postmaster-general, and Secretary of State for India; but in 1881 he resigned office on the question of the Irish Land Bill. In 1899 he presented Iona cathedral to the Church of Scotland. Among his principal works are *The Reign of Law* (1866; 19th ed. 1890); *Primæval Man* (1869); *The Unity of Nature* (1884; 2nd ed. 1888); *Poems* (1894); and *The Philosophy of Belief* (1894). See *George Douglas, eighth Duke of Argyll*, ed. by Dowager Duchess of Argyll (1906). His eldest son, John Douglas Sutherland, ninth duke (b. 1845), married, in 1871, Princess Louise, daughter of Queen Victoria. From 1878-83 he was governor-general of Canada, and since 1902 governor and constable of Windsor Castle. He is the author of *Canadian Pictures* (1884); *Imperial Federation* (1885); *Life of Lord Palmerston* (1892); *Life of Queen Victoria* (1901); *Passages from the Past* (1907), etc.

Argyllshire, a maritime co. in the w. of Scotland, with an ex-

treme length from n. to s. of 115 m., and a coast-line, owing to its numerous sea lochs, of 2,290 m. It has an area of 3,110 sq. m., and is very mountainous. The chief mountains are Ben Starav (3,541 ft.), Stob Gabhar (3,565 ft.), Bidean nam Bian (3,766 ft.), and Ben Cruachan (3,611 ft.). The rivers are the Orchy and the Awe. The lochs comprise Loch Fyne, famed for its herring; Loch Shiel, for its salmon and sea trout; and Loch Awe (fresh water), for its salmon, trout, and eels. Glencroe and Glencoe are the most picturesque glens. The principal islands are Coll, Mull, Staffa, Iona, Islay, Jura, Lismore, Tyree, and Colonsay. The county town is Inveraray. Herring-fishing, slate (Ballachulish and Easdale) and granite-quarrying (near Inveraray and at Bonawe near Oban), coal-mining (near Campbeltown), and whisky-distilling (Campbeltown and Islay) are the chief industries. At Kinlochleven, on Loch Leven, are large works for the production of aluminium by means of electricity generated by water power. Highland cattle are largely reared. In the s. the climate is mild, but in the n. it is severe, the snow lying on the hills for months. Argyllshire returns one member to Parliament, and Argyll and the Islands form one of the seven bishoprics of the Scottish Episcopal Church. Pop. 74,000. See Lord A. Campbell's *Records of Argyll* (1885); Brown's *Memorials of Argyllshire* (1889); Gillies's *Place Names of Argyll* (1906).

Argyria, a dark gray permanent pigmentation of the skin, caused by the internal use of compounds of silver; most pronounced in those parts exposed to the light.

Argyrokastron. See ERGERI.

Argyropulos, JOANNES (1416-1486?), humanist, was born in Constantinople, but on the fall of that city he went to Rome (1453), where

he soon became a renowned Greek teacher, passing from Rome to Padua, and from Padua (on the invitation of Cosimo de' Medici) to Florence (1456), where among his pupils were Piero and Lorenzo de' Medici. In 1471 he moved to Rome, where he died. Poliziano and Reuchlin were also pupils of his. His principal works were translations of Aristotle's treatises, with commentaries.

A.R.H.A., abbreviation for Associate of the Royal Hibernian Academy.

Ari Thorgilsson (1067-1148) surnamed 'the Learned,' or 'the Wise,' Icelandic historian and genealogist, one of the first to reduce to writing, in Roman characters, the traditional tales of the Norsemen. He also wrote or compiled the *Landnamabok*, the 'Domesday Book' of Iceland; the *Konungabok*, a history of Norway; *Islendingabok*, an account of the old Icelandic constitution; and *Kristni Saga*, the story of the Christianizing of Iceland.

Aria (It.), a rhythmical air, song, or tune. The term is commonly applied to a song for a single voice with instrumental or vocal accompaniment, and introduced into such works as oratorios, operas, and cantatas. Beethoven's *Ah Perfido* and Mendelssohn's *Infelice* are model specimens.

Ariadne, daughter of Minos, king of Crete, the lover and helper of Theseus, to whom she gave the clue of thread whereby he extricated himself from the labyrinth after slaying the Minotaur. A legend relates her desertion by Theseus and succour by Dionysus (Catullus 64, and Kingsley's *Heroes*), who married her, and placed her among the stars. Her name is attached to the 43rd asteroid.

Ariana, a prov. of ancient Persia, coinciding roughly with the modern Khorassan; in a wider sense it embraced the E. half of

the Persian empire, and extended E. to the Indus and N. to the Oxus and Jaxartes.

Arian Controversy. See **ARIUS**.

Ariano, tn., Rovigo, prov. Venetia, Italy, on a branch of the Po delta, 35 m. S. of Venice. Pop. 7,000.

Ariano di Puglia, tn. and episc. see, prov. Avellino, Italy, stands on the Apennines, 2,505 ft. above sea-level, 24 m. by rail E. of Benevento. Sulphur is mined and marble quarried; the liqueur *rosoglio* is also made. Pop. (comm.) 18,000.

Arias Montanus, BENEDICTUS (1527-98), Spanish theologian and Orientalist, member of the Council of Trent. He edited the Antwerp Polyglot Bible (1568-72); wrote *Jewish Antiquities* (1593). See *Life* by Loumyer (1842), and Antonio's *Bibliotheca Hispana Nova*.

Aribert, or HERIBERT (d. 1045), was of a noble Lombard family, and became archbishop of Milan in 1018. He was a partisan of the Ghibelline (Imperial) party, and invited to Italy the Emperor Conrad II., whom he crowned as king of Milan in 1026.

Arica, seapt., N. Chile, 125 m. N. of Iquique, connected by a railway (39 m. long) with Tacna. Goods are landed here for Bolivia. Some guano, salt, copper, and sulphur are exported. It has suffered repeatedly from earthquakes. Pop. 3,000.

Arichat, fishing tn. on S. side of Madame I., Nova Scotia, Canada; chief town of Richmond co.; has a fine harbour, and is the seat of a Roman Catholic bishop. Lead is mined in the vicinity. Pop. 1,000.

Ariège, dep., S. France, on frontier of Spain and Andorra, with the main ridge of the Pyrenees running W.N.W. (highest point in the department, Pic d'Estats, 10,300 ft.) as the S. limit. It lies mainly in the valley of the Ariège

and its tributaries, the w. part of the department draining to the Garonne. In spite of its general altitude the climate is not cold, and there are some delightful summer resorts. The lower plains are fertile—cereals, vegetables, fruits, and vines being grown—and the pasturage of the highlands supports great flocks of sheep. Reforestation has begun. The industries are wool-working and iron-mining. Lead, copper, zinc, and manganese occur. Area, 1,893 sq. m. Pop. 205,000. Cap. Foix. See Duclos's *Histoire des Ariègeois* (1881-7).

Ariel, the name of two characters in the Old Testament (Ezra 8:16; 1 Chron. 11:22). In Isa. 29:1, 2, 7, Ariel is used of Jerusalem. It may mean 'lion of God,' or 'hearth of God;' but Isaiah probably intends by paronomasia to predict that Uriel (*i.e.* Urusalem or Jerusalem), 'God's enclosure,' was to become Ariel, a sacrificial hearth—*i.e.* a place of slaughter. See Cheyne's *Isaiah*. For Shakespeare's Ariel, see *The Tempest*.

Aries, a zodiacal constellation which originally marked the first sign of the zodiac, entered by the sun at the vernal equinox, and denoted by the symbol φ . Owing to the effects of precession, the passage of the sun through Aries has been shifted forward from April 16 to May 13. α Arietis shows a spectrum of solar type, and is approaching the sun at the rate of 8 m. a second; β is a spectroscopic binary, period, 107 days; γ was one of the first stars discovered to be double, being observed by Hooke in 1664; θ and ϵ are binaries, and π is a triple system.

Arikara, or ARIKAREE, American Indians, a part of the Caddoan linguistic family and members of the Pawnee confederacy, were formerly associated with the Skidi. According

to tradition they separated, and the Arakara migrated to the vicinity of Fort Berthold, N. Dakota, where their descendants now reside.

Aril, or ARILLUS, an additional coat formed in some plants from the placenta or from the funicle of an ovule, which grows up incompletely around the ovule while it is ripening. Examples of the aril are the scarlet coat of a yew seed and the mace of nutmeg.

Arimanes. See AHRIMAN.

Arimaspes, or ARIMASPIANS, a mythical people of Asia, who were supposed to live on the east coast of the Caspian Sea. They had only one eye, were warlike, and continuously at war with the Griffins for the possession of the gold dust of the river Arimaspius. They are referred to in Herodotus and in Milton's *Paradise Lost*.

Ariminum, the ancient name of Rimini, Italy.

Arion OF METHYMNA, in Lesbos, lived at Corinth about 625 B.C.; was one of the earlier Greek lyric poets, and developed the dithyramb or choral song in honour of Dionysus—an important step in the development of Greek tragedy. The one extant fragment attributed to him is probably a forgery (see Bergk's *Poetae Lyrici Græci*, new ed. 1900).

Ariosti, ATTILIO (c. 1660-1740), Italian musician and composer. Handel, Bononcini, and Ariosti were employed together to produce Italian opera in England in 1720. He composed fifteen operas, the most popular being *Coriolano*. He has been credited with the invention of the *viol d'amore*.

Ariosto, LUDOVICO (1474-1533), Italian poet, was born at Reggio in Emilia. In 1503, after he had written two comedies, *La Cassaria* and *I Suppositi*, and several lyric poems, he was taken into the service of Cardinal Ippolito d'Este. While residing in Ferrara, Ariosto wrote his great poem *Orlando Fu-*

rioso, which was published in 1516 in its first form, in forty cantos. Quarrelling with the close-fisted cardinal in 1518, Ariosto transferred his services to Alfonso of Ferrara. Soon after the 2nd edition of his *Orlando* appeared, in 1521, the duke sent Ariosto to the wild province of Garfagnana, to suppress various robber bands. After returning to Ferrara he produced three new comedies—*La Lena*, *Il Negromante*, and *La Scolastica*. He also wrote seven satires, after the manner of Horace, and a tract, entitled *Erbolate*, on the dignity of man and the science of medicine. For some years he laboured anew at the *Orlando*, which appeared in its final form in 1532, in forty-six cantos. He died in 1533, and was buried in the church of San Benedetto at Ferrara, where a splendid tomb of marble was erected.

The *Orlando Furioso*, upon which Ariosto's immortality rests, is one of the great poems of the world, and one of the very first epics in the sphere of chivalry and romance. Taking up the theme first undertaken by Boiardo in the *Orlando Innamorato*, Ariosto elaborated it, celebrating the origin of the family of Este, and the loves and exploits of Ruggieri and Bradamante. The second part of the argument deals with the wars between Charlemagne and the Saracens, while the madness and recovery of Orlando form the third argument or action of the poem. A good new edition of the *Orlando Furioso* was issued by Picciola in 1885. The best-known translations into English are those by Harrington (1591), Hoole (1773–83), and Stewart Rose (1823). The *Satires* have been translated by Markham (1608) and Croker (1759). See Life prefixed to Cappelli's *Lettere di L. Ariosto* (3rd ed. 1887); *Life* by G. Campori (3rd ed. 1896); and Gardner's *The King of Court Poets* (1906).

Ariovistus, German chief, requested by the Sequani to help them against the Ædui, by whom they were hard pressed. He subdued the Ædui, and seized territory from the Sequani as his reward. Sequani and Ædui now combined, and invoked the aid of Cæsar, who defeated Ariovistus and his hordes about 50 m. from the Rhine (B.C. 58). Ariovistus escaped across the river in a small boat, and nothing more is known of him. See Cæsar's *Gallic War*, bk. i.

Arista, MARIANO (1802–85), Mexican general and statesman. In the war with the United States in 1846 he was defeated by General Taylor at Palo Alto and Resaca de la Palma. He was war minister under Herrera in 1848, and was elected president in 1851. He resigned in 1853, and was banished.

Aristæus, a Greek deity, the reputed son of Apollo and the huntress nymph Cyrene. He married Autonoe, the daughter of Cadmus of Thebes, and by her had a son, Actæon. He was a rural god, who protected cattle, game, vine and olive culture, and especially the management of bees. Virgil tells (*Georgic* iv.) how he angered the nymphs by his chase of Eurydice, for whose death they took vengeance by destroying Aristæus's bees, and the miraculous way in which he recovered them.

Aristagoras OF MILETUS (d. 497 B.C.), brother-in-law of Histæus the despot, who left him governor of the town while he was at the Persian court. In 501 B.C. Aristagoras failed to capture Naxos for the Persians, and, fearing punishment, initiated the Ionian revolt against Persia. Sparta refused aid; but Athens sent ships and troops, with which he burnt Sardis, though he was soon driven back to the coast. The Athenians went home, and the Persians took most of the Ionian cities—Aristagoras fleeing

to Thrace, where he fell in battle against the Edonians.

Aristarchus OF SAMOS (fl. c. 280-264 B.C.), ancient Greek astronomer, whose one surviving work treats of the distances of the sun and moon from the earth. He appears to have believed the sun to be at rest and the earth in motion.

Aristarchus OF SAMOTHRACE (c. 150 B.C.), ancient Greek grammarian and critic, was educated at Alexandria, and founded a school of criticism himself, which flourished there, and afterwards at Rome. He is said to have left Egypt in his old age, as Ptolemy Physcon, the reigning monarch, treated scholars badly, and to have retired to Cyprus, where, at the age of seventy-two, he starved himself to death, as he was suffering from an incurable dropsy. His whole life was devoted to the study and criticism of the Greek poets, and especially Homer. It was by his labours that the text of Homer as we possess it, with the division of both *Iliad* and *Odyssey* into twenty-four books, was constituted, though later corruptions have overlaid his edition to some extent. His aim was to restore the genuine text: verses which he considered spurious he marked with an obelus, and those of particular beauty with an asterisk. None of his writings survive in integrity. See Lehr's *De Aristarchi Studiis Homericis* (3rd ed. 1882); Ludwig's *Aristarchs Homerische Textkritik* (1885).

Aristeides, or ARISTIDES (fl. 360-330 B.C.), Greek military painter, whose work, *The Capture of a City*, was taken by Alexander the Great to Macedon; while *A Battle with Persians*, containing a hundred figures, was purchased by Mnason of Elatea; and a portrait of *Bacchus* was bought by Attalus, king of Pergamus, and brought to Rome by L. Mummius.

Aristeides, or ARISTIDES, OF ATHENS (c. 530-468 B.C.), son of Lysimachus, surnamed 'the Just,' was a leading Athenian statesman at the time of the Persian wars and afterwards. In 490 B.C. he commanded his tribe at Marathon; the next year he was archon; in 482 he was ostracized—i.e. banished by popular vote—for five years, as a result of his rivalry with Themistocles. Returning in 480, he rendered conspicuous service at the battle of Salamis, commanded the Athenian forces at Plataea (479), and drew up the assessment of the confederate states which joined Athens in the Delian League (476). He proposed, or supported, the throwing open of the archonship to all Athenians (c. 478). He died so poor that his funeral expenses were paid by the state, which also portioned his daughters, and gave a grant of land to his son Lysimachus. As compared with his rival Themistocles, his policy was lacking in foresight and breadth. He has been represented as an oligarchical and conservative politician, and probably favoured friendship with Sparta. See Plutarch's *Life of Aristides*.

Aristeides, or ARISTIDES, PUBLIUS ÆLIUS, surnamed THEODORUS (129-189?), Greek rhetorician, was born at Adriani in Mysia, and studied under Herodes Atticus and Polemon of Pergamus. After his return from travels in Greece, Italy, Egypt, and Asia, he was seized (155) with an illness which lasted for seventeen years, and is described in his six *Sacred Discourses*, which contain descriptions of visions, dreams, and cures. His account of these cures has excited attention, because of their similarity to the effects of hypnotism. Removing to Smyrna, he became a favourite of the Emperor Marcus Aurelius; and when the town was destroyed

by an earthquake (178), he induced the emperor to rebuild it. He died at Smyrna about 189. Fifty-five of his orations and two treatises of rhetorical and technical importance are still extant. The best complete edition of his works is that of Keil (1898, etc.). See Baumgart's *Aristeides* (1874).

Aristippus OF CYRENE (c. 430–360 B.C.), founder of the Cyrenaic school of philosophy, was a pupil of Socrates, lived at the court of Dionysius, the tyrant of Sicily, but returned to Cyrene in his old age. He was the first of Socrates' followers to take pay for teaching; and for this reason, and because of his philosophy of pleasure, he was attacked by Plato and Xenophon. Aristippus developed the utilitarianism of Socrates into an acknowledged hedonism: the pleasure of the moment is the sole end of action; pain is the greatest evil; knowledge also is purely sensational; truth exists simply in relation to each individual, and universal truth is impossible. Aristippus is mentioned by Plato, Xenophon, Aristotle, Diogenes, Laertius, and constantly by Horace. See also Zeller's *Socrates and Socratic Schools* (Eng. trans. by Reichel, 1877).

Aristobulus (c. 150 B.C.), founder of the Jewish-Alexandrian philosophy. He endeavoured to show that the Greek poets and philosophers drew their matter from the sacred books of the Jews.

Aristobulus I. (d. 105 B.C.), high priest of the Jews, a son of the Maccabean prince, John Hyrcanus. In 107 B.C. he was the first after the Babylonian captivity to assume the title of king in Judæa. He conquered Ituræa, and attempted to proselytize the inhabitants.—His nephew, **ARISTOBULUS II.**, led a successful rebellion of the Sadducees against his brother, Hyrcanus II., in 69

B.C. He was captured by Pompey in 63 B.C., and taken to Rome.

Aristocracy (Gr. 'rule by the best') is a government controlled by the nobility or privileged class. See GOVERNMENT.

Aristodemus, hero of the first Messenian war with Sparta (743–724 B.C.), belongs to legend rather than history. He slew his daughter as a sacrifice to save his country; was elected king in 731; and killed himself on his daughter's tomb.

Aristolochia, a genus of plants found in temperate and tropical countries, except Australia. The only species in Britain is *A. clematitis* (birthwort). The corolla forms a trumpet-shaped tube similar to the spathe of the arum, which attracts and imprisons insects until fertilization is effected. Many of the species form twining lianas, the best known being the plant that produces the enormous 'pelican flower,' sometimes seen in hothouses. *A. siphon* is an American species known as Dutchman's pipe. *A. serpentaria* (Virginian snake-root) and other species supply remedies for snake-bite.

Aristomenes, the chief figure on the Messenian side in their second war with Sparta (685–668 B.C.); elected king of the Messenians in 684 B.C.; resisted the Spartans in the mountain fortress of Ira for eleven years, and, when the fortress was captured, retired (668) to Rhodes.

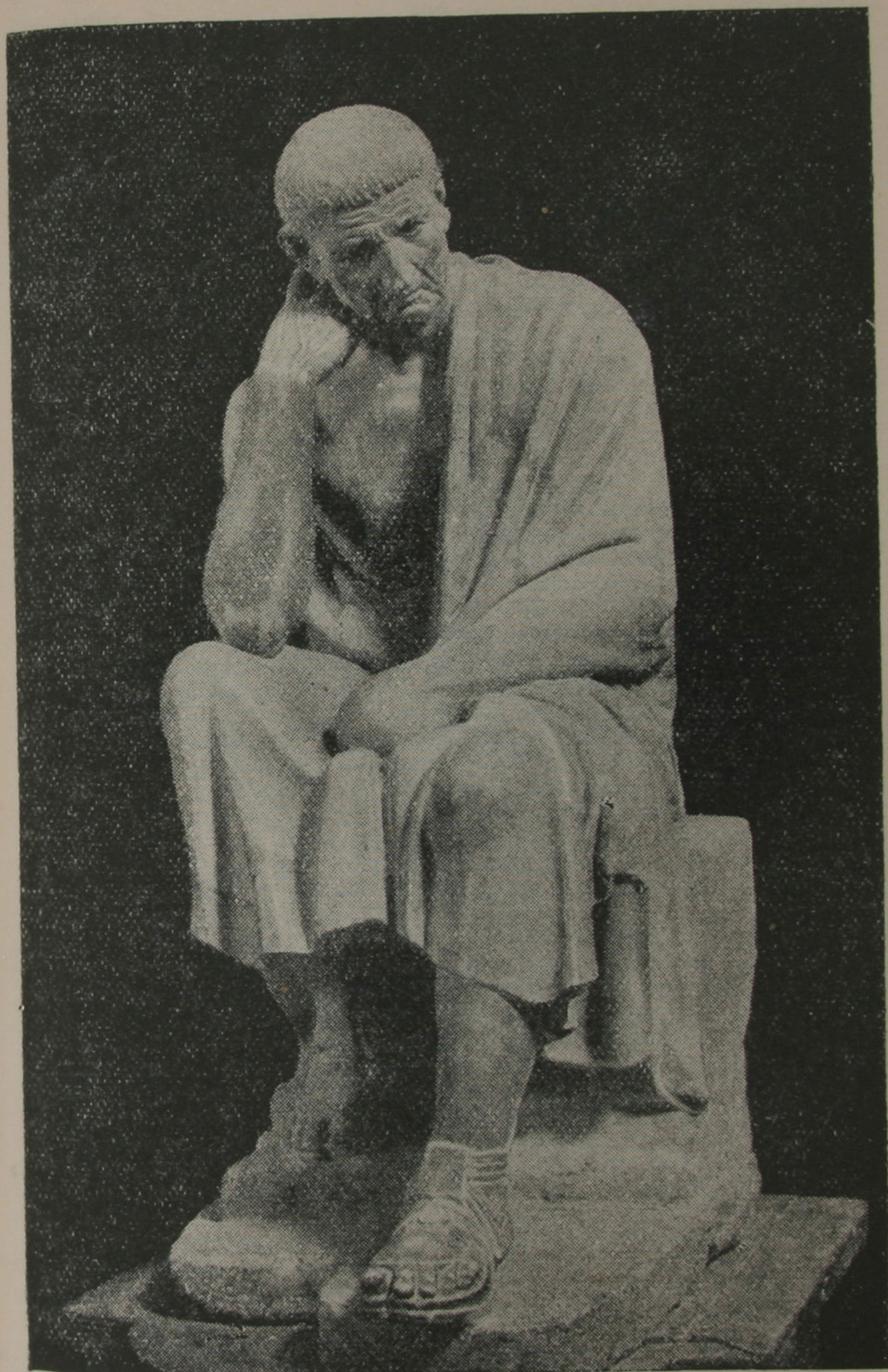
Aristophanes (c. 444–380 B.C.), the greatest comic poet of Athens and of Greece. His father Philipus came from Ægina, which cast some doubt on the Athenian citizenship of Aristophanes; and the popular statesman Cleon brought more than one unsuccessful action against him to deprive him of civic rights. This partly accounts for Aristophanes's extreme bitterness against Cleon. His first play—the *Banqueters*, which is lost—was produced for him by a

friend (427 B.C.), as he was too young to compete. Of his greater works, the *Acharnians* appeared in 425, the *Knights* in 424, the *Clouds* (probably) in 423, and a revised edition in 422; the *Birds* in 414, the *Frogs* in 405, and the *Women in Parliament* in 392. His last play seems to have been acted in 387 B.C. Aristophanes was by far the greatest poet of the old Attic comedy, which was distinguished by its bold and outspoken criticism and caricature of public men by name; indeed, leading men were often made characters in his comedies—as Nicias, Cleon, and Demosthenes in the *Knights*, Socrates in the *Clouds*, and Euripides in the *Acharnians*. It is this personal criticism which gives a great historical value to his plays; but his excellence as a comedian depends more truly on other qualities—the originality of his plots, the humour of the situations, the keenness of his wit, the vigour, grace, and delicacy of his language, the smartness of his dialogue and repartee, and the perfection of his lyrical passages. Two of his favourite artifices are what is called the ‘unexpected’ joke (*i.e.* finishing a sentence with a quite unlooked-for word), and the use of new and extraordinary compound words—in which he was assisted by the aptitude of Greek for forming compounds—such as ‘signet-ringed, long-haired dawdler,’ denoting the fop; and a word of about 170 letters, describing a dish composed of every possible ingredient—fish, flesh, fowl, and vegetable. Aristophanes was a conservative, and disliked the new school of philosophy, education, and poetry represented by Socrates and Euripides. The *Birds*, perhaps his finest play, supposed the foundation of a ‘Cloud-cuckoo-city,’ in ridicule of the ambitious aspirations of his day. In the *Women*

in *Parliament* he caricatures Plato’s *Republic*, which contended for the perfect equality of the sexes. The *Wasps* ridicules the excessive litigation of the Athenians. As a comic genius he was on a level with Shakespeare and Molière. Editions: text alone, Blaydes (1886); with notes, the editions of separate plays by Kock (German) and Merry (1887–1901). Mitchell has translated the *Acharnians*, *Knights*, *Clouds*, and *Wasps* (1822); Frere the same without the *Wasps*, but including the *Frogs* and *Peace* (1871); B. B. Rogers various plays (1867–1910). Racine’s comedy *Les Plaideurs* is an imitation of the *Wasps*.

Aristophanes OF BYZANTIUM (*c.* 264 B.C.), Greek scholar and critic, pupil of Zenodotus and Eratosthenes, and master of Aristarchus, was chief librarian of the Great Library at Alexandria. He introduced the use of accents in Greek. Some fragments of his works remain in the scholia to various poets, and some plots prefixed to tragedies and comedies.

Aristotle is rightly called by Dante ‘the master of them that know’ (*Inf.*, iv. 130); for he first marked out the path all science was to follow, and first took all knowledge to be his province, although he had little appreciation of mathematical ways of thinking. Aristotle is called ‘the Stagirite,’ from Stageira (or Stagiros), in Chalcidice, where he was born in 384 B.C. The profession of medicine was hereditary in his family. At the age of seventeen he came to Athens, ‘the school of Greece,’ in search of that wider culture of which Isocrates was then the great professor; but it was in the Academy, the school of Plato, alone that he could find intellectual satisfaction. Plato was then about sixty years old. Aristotle always speaks of him with reverence, though he was driven to reject his most characteristic doc-



Aristotle, the 'Master of them that know' (384-322 B.C.).

trine, that of 'ideas,' or rather 'forms' (see PLATO), at least in its original shape.

Aristotle agreed with Plato in holding that all science is of the 'form,' the universal element in things; but he would not draw the inference, so natural to a mathematician like Plato, that the 'forms' alone were real, and that the manifold objects of sense only existed in so far as they 'partook of' them. Still less could he follow him in his later reduction of the 'forms' to 'numbers' or mathematical formulæ. As a biologist, he was most interested in those 'forms' which constitute the genera and species of animals and are reproduced by generation, and these, though the true object of science, are actual only in individuals. There is a 'form of man,' because 'man begets man;' but it is not a one 'alongside of the many,' but a one which is true 'of the many.'

Aristotle was about thirty-seven when Plato died (347 B.C.). He is said to have been disappointed at not being chosen head of the Academy. It was natural that Plato's nephew, Speusippus, should be preferred, for he was in full sympathy with the later mathematical development of Platonism, which Aristotle did not care for or perhaps even understand. However that may be, Aristotle left Athens in company with Xenocrates, who succeeded Speusippus later on, and the two found a patron in Hermeias, prince of Atarneus in Mysia, whose niece, Pythias, Aristotle married. Before long, however, he was invited by Philip of Macedon to direct the education of his son Alexander; but no trace of Aristotle's influence can be discovered in the career of Alexander the Great. The fusion of Greeks and Persians, which was Alexander's ideal, is directly opposed to Aristotle's doctrine of a 'natural' distinction between

the free Hellene and the 'barbarian,' for whom it is better to be a slave. On the other hand, Aristotle never saw that the foundation of a military empire by his brilliant pupil had made his favourite city-state an anachronism. Each had, doubtless, too original a mind to be much influenced by the other. On the accession of Alexander, Aristotle returned to Athens in 335 B.C. Isocrates was now dead, and Speusippus had been succeeded by Xenocrates, so the way was clear for him to found a school of his own on the model of the Academy.

Like Plato, Aristotle set up his school in a 'gymnasium' outside the town. This was the Lyceum, once a favourite haunt of Socrates; and the school itself came to be known as the Peripatos, from a covered walk (*περίπατος*) in which the lectures were given. The term 'peripatetic' is later, and is due to a confusion, for it implies that the followers of Aristotle derived their name from some custom of walking about while teaching. The school was a society with a regular organization and a corporate life. Scientific work was done in common, and its results were embodied in courses of lectures (*ἀκρόασεις*), which were constantly revised and kept up to date by Aristotle himself. It is these lectures that have come down to us as the works of Aristotle. But we also possess numerous fragments of discourses and dialogues in the manner of Plato and Isocrates; and in 1891 a whole treatise on the *Constitution of Athens*, discovered on a papyrus roll in Egypt, was published for the British Museum by Mr. Kenyon. Cicero admired the style of the dialogues, and speaks of Aristotle's 'golden stream of language' (*Acad. Post.*, ii. 38, 119). It is very important, in comparing Aristotle with Plato, to bear

in mind that we possess all Plato's literary works, and not a word of his lectures in the Academy; while we have only Aristotle's lectures, and no more than scraps of his published writings.

The death of Alexander revived the activity of the nationalist and democratic party at Athens, and Aristotle was threatened, like Socrates two generations earlier, with a prosecution for 'impiety.' He fled to Chalcis in Eubœa, and died the next year (322 B.C.).

Aristotle's most original creation was the science afterwards called Logic, as contained in the collection of treatises to which the name *Organon* ('instrument') was given at a later date. The first of these, the *Categories* (probably post-Aristotelian), gives the forms of predication—substance, relation, quality, quantity, etc. The *De Interpretatione* (*περὶ ἑρμηνείας*, 'on the expression of thought by language') deals with affirmation, negation, and the like. The *Prior Analytics* treats of the syllogism, with its moods and figures; while the *Posterior Analytics* gives the theory of demonstrative science based on this. The term 'analytics' is taken from mathematics, and describes the scientific process. Each science has certain 'starting-points' (*ἀρχαί*) or 'principles' (*principia*), which cannot be demonstrated any more than the individual at the other end of the scale. Science lies between these extremes, and analysis consists in discovering the intermediate steps, or 'middle terms.' It therefore finds its proper expression in the syllogism, in which a conclusion is shown to follow necessarily from two premises, each containing the middle term, which does not itself appear in the conclusion. As 'first principles' cannot be known in this way, our knowledge of them is

'immediate' or 'intuitive' in the sense that their truth is apprehended by perception alone. It does not follow, however, that they are easily apprehended; a long process of 'induction' may be required.

In the middle ages this logical system, as is well known, dominated all thought; but it was apt to be used as a mere device for developing conclusions from 'given' premises. The revolt against Aristotelian logic was really a revolt against this misunderstanding; for to Aristotle himself no syllogism was scientific unless its premises were 'true and more known than the conclusion,' and unless they expressed 'the cause of the conclusion.' Reasoning of the other sort—that based upon premises admitted or assumed—is necessary, indeed, in rhetoric, and in subjects which do not admit of scientific accuracy; and this forms the subject of the *Topics* (*τόποι, loci communes*), the last book of which deals with fallacies, and is known by the distinctive title of the *Sophistici Elenchi*. The 'organon' forms a propædeutic to all science.

Science itself was divided by Aristotle into theoretical and practical. The objects of theoretical science are either unmoved, or have their source of motion in themselves; and it has three branches—mathematics, physics, and first philosophy, or theology. The first of these Aristotle left practically untouched. By physics (*φυσικὴ*) he meant the science of everything that has its source of motion or efficient cause in itself, including, of course, organic life. This has to be studied in the light of the four causes—the material, the efficient, the formal, and the final. As, however, the final cause or 'end' of a thing is to attain its form, and as it is the form appearing

as an end that is ultimately the efficient cause of the process from potentiality (*δύναμις*) to actuality (*ἐνέργεια*), the four may be reduced to two—matter (*ὑλη*) and form (*εἶδος*). This amounts to a theory of teleological evolution. Matter is purely negative; it only exists potentially—*i.e.* in so far as it is capable of becoming actual through form. The course of lectures specially called the *Physics* (*Φυσικὴ ἀκρόασις*) deals with this process, and in particular with motion, time, space, and the like; while the *De Generatione et Corruptione* (*περὶ γενέσεως καὶ φθορᾶς*) treats of coming into being and ceasing to be. The *De Cælo* (*περὶ οὐρανοῦ*) applies the theory to the structure of the universe; while the *Meteorologica* deals with particular phenomena. Coming to organic life, the *De Anima* (*περὶ ψυχῆς*) explains the soul or vital principle as the formal cause of a body potentially living. The *Historia Animalium* contains an astonishing mass of observations made chiefly from a teleological point of view, and thus prepares the way for the great biological treatises on the *Parts of Animals*, the *Locomotion of Animals*, and the *Generation of Animals*.

First philosophy, or theology, is said to be the science of 'the real as real.' It is represented in the Aristotelian corpus by certain treatises which do not stand in any clear order of connection, and some of which seem to be unfinished. They were placed after the *Physics*, and from this fact received the title *Τὰ μετὰ τὰ φυσικά*—an accident to which we owe the name *Metaphysics*. It appears that Aristotle never finished this part of his system, or harmonized it with the rest. The source of all motion is itself unmoved, and the way in which it acts can only be expressed by

saying that it 'moves as an object of love.' It is pure actuality, in which there is nothing merely potential. It is pure mind, with no object but itself; it is thought, with thought as its object—pure self-consciousness, with nothing beyond. It is God, and yet it enters somehow into man, and can only be described in the language of mysticism. The aspect of reality, which Aristotle had sought to ignore by his rejection of Plato's 'forms,' forced itself upon him here; but there is much uncertainty as to the real meaning of particular doctrines.

Practical science has to do with things that have their source of motion in us; in it we are not merely spectators, but actors. Its 'first principle,' then, will not be a statement of what is, but a definition of something that is to be, of an end, and its 'middle terms' will be the means of realizing that end. The good for man was called 'happiness' (*εὐδαιμονία*) in the Academy, and Aristotle adopts the term. He prefers, however, to say 'the good life' (*τὸ εὐφύην*), as this brings out his characteristic doctrine that it is an activity, not a mere state or condition, as the Academy taught. The treatise called the *Nicomachean Ethics* (perhaps because it was edited by his son Nicomachus) discusses this end, and analyzes the means of its realization. Happiness is an activity, and it is an activity in accordance with the best form of goodness. Goodness is of two kinds—intellectual goodness, and goodness of character. Goodness of character is a habit of feeling and acting in a mean between extremes—*i.e.* of feeling and doing neither too much nor too little, but just what is right; and this is shown by a detailed description of the various forms of goodness, along with the forms of badness arising from deficiency or excess in each case.

But the mean must have a standard to fix it; for it is not merely quantitative, as we might suppose. This is found in practical wisdom (*φρόνησις*), the wisdom of the lawgiver who has in his soul the 'form' of goodness, as the doctor has that of health. Now this wisdom belongs to intellect, not to character; but it is not the highest form of intellectual goodness. That is theoretical wisdom (*σοφία*), which has to do with the loftiest things in the world. This, then, is the highest form of goodness, and an activity according to it will be the highest happiness. It cannot, however, exist unless the state is organized in such a way as to make it possible. This brings us to the *Politics*, which teaches us how the state, having once come into being, through the family and the village, for the sake of mere life, exists for the sake of the good life, and how the best may be made of it in all circumstances.

One department of human activity is production, and the theory of this would include all the arts. The highest of these are the arts of imitation (*μίμησις*), which arise from an instinct of human nature. The fragment called the *Poetics*, which deals with tragedy, is practically all that remains under this head. It shows that the function of tragedy is that of a 'purge' (*κάθαρσις*) in medicine. The emotions of pity and fear are apt to accumulate in the mind, and to produce a morbid condition. Tragedy works off these feelings on a noble object in which we have no mean interest. The technical discussion of the structure of tragedy—the 'unities' and the like—has had more influence upon the history of literature and criticism than the main theory, which has generally been misunderstood. It is convenient to mention the *Rhetoric* along with the *Poetics*, though Aristotle

hardly intended it to occupy this place in his system. It is a fulfilment of the demand, made by Plato in the *Phædrus*, that the art of rhetoric should be based upon psychology and treated in a philosophical spirit.

Such, in bare outline, is the system of Aristotle; but no outline can give any suggestion of the enormous mass of detailed observation upon which it is built up, and by which it is illustrated. Aristotle had a love of facts for their own sake, but he always saw them in the light of universal principles. His immediate followers lost themselves in detail, and became antiquarians and collectors of scientific curiosities. The revived Aristotelianism of the middle ages was weak on the other side. The leading principles were grasped clearly enough, but the content was unscientific. The true heirs of Aristotle's spirit are the scientific men of our day.

See Zeller's *Aristotle and the Earlier Peripatetics*, trans. by Costelloe and Muirhead (2 vols. 1897). The chief English works are Grote's *Aristotle* (2 vols. 1872)—deals with the life of Aristotle—the *Organon*, *De Anima*, and *Metaphysics*; G. H. Lewes's *Aristotle: a Chapter from the History of Science* (1864)—deals chiefly with the physics and biology. For the *Ethics* and *Politics*, see the essays in Sir Alexander Grant's edition of the *Nicomachean Ethics* (4th ed. 1884), 2 vols., and the introduction to Newman's edition of the *Politics* (4 vols. 1887-1901). For the *Poetics*, Butcher's *Aristotle's Theory of Poetry and Fine Art* (3rd ed. 1903), and Bywater's edition and translation (1909); for the *De Anima*, Hicks's ed. (1907); for the *Metaphysics*, Ross's trans. (1905); and for the *Rhetoric*, the edition by Cope and Sandys (3 vols. 1877). See also Burnet's *Aristotle on Education* (1903).