and is distinguished by the name indigolite, generally written indi- colite. Brown is a common colour, and black still more common, this being the usual colour of schorl, or common coarse tourmaline. Thin splinters of schorl may, however, be blue or brown by transmitted light.

The double refraction of tourmaline is strong. The mineral is optically negative, the ordinary index being about 1∙64, and the extraordinary 1∙62. Coloured tourmalines are intensely pleochroic, the ordinary ray, which vibrates perpendicular to the principal axis, being much more strongly absorbed than the extraordinary ; hence a slice cut in the direction of the principal or optic axis transmits sensibly only the extraordinary ray, and may consequently be used as a polarizing medium. The brown tourmaline of Ceylon and Brazil is best adapted for this purpose, but the green is also used. Two plates properly mounted form the instrument used by opticians for testing spectacle-lenses, and are known as the “ tourmaline tongs.” In order to secure the best colour-effect when used as a gem-stone, the tourmaline should be cut with the table parallel to the optic axis.

It was in tourmaline that the phenomenon of pyroelectricity was first observed. On being heated in peat ashes its attractive power was observed by the Dutch, in the early part of the 18th century; and this curious character obtained for it the name of *aschtrekker,* or ash-drawer. J. R. Haüy first pointed out the relation of pyroelectricity with hemimorphism. Tourmaline is also piezoelectric, that is, it becomes electric by pressure. If a crystal be subjected to pressure along the optic axis, it behaves as though it were contracting by reduction of temperature. The mineral may also be rendered electric by friction, and retains the charge for a long time.

Tourmaline is a boro-silicate of singularly complex composition. Indeed the word tourmaline is sometimes regarded as the name of a group of isomorphous minerals rather than that of a definite species. Numerous analyses have been made, and the results discussed by a large number of authorities. In the view of S. L. Penfield and H. W. Foote all tourmaline may be derived from a boro-silicic acid of the formula H20B2Si4O21. It is believed that the hydrogen is present as hydroxyl, and that this may be partially replaced by fluorine. The tourmaline acid has probably the con- stitution H18(B∙OH)2Si4O19. Nine atoms of hydrogen are replaced by three of aluminium, and the remaining nine in part by other metals. Lithium is present in red tourmaline ; magnesium dominates in brown; iron, manganese and sometimes chromium are found in green; and much iron occurs in the black varieties. Four groups are sometimes recognized, characterized by the presence of (1) lithium, (2) ferrous iron, (3) ferric iron and (4) magnesium.

Tourmaline occurs commonly in granite, greisen, gneiss and crystalline schists. In many cases it appears to have been formed by pneumatolysis, or the action on the rocks of heated vapours containing boron and fluorine, as in many tin-bearing districts, where tourmaline is a characteristic mineral. Near the margin of a mass of granite the rock often becomes schorlaceous or tourma- liniferous, and may pass into “ tourmaline-rock,” which is usually an aggregate of tourmaline and quartz. Tourmaline is an essential constituent of the west of England rocks called luxullianite (luxuly- anite) and trowlesworthite. It occurs embedded in certain meta­morphic limestones, where it is possibly due to fumarolic action. Microscopic crystals are common in clay-slate. By resistance to decomposition, tourmaline often survives the disintegration of the matrix, and thus passes into sands, clays, marls and other sedimentaty deposits.

Many of the finest crystals of tourmaline occur in druses in granitic rocks, such as those of San Piero in Elba, where some of the pale pink and green prisms are tipped with black, and have consequently been called “ nigger-heads.” Lepidolite is a common associate of tourmaline, as at Rozena in Moravia. Tourmaline occurs, with corundum, in the dolomite of Campolongo, in canton Ticino, Switzerland. Fine black crystals, associated with apatite and quartz, were formerly found in granite at Chudleigh, near Bovey Tracey in Devonshire. The Russian localities for tourmaline are mentioned under Rubellite. Most of the tourmaline cut for jewelry comes from the gem-gravels, of Ceylon. The green tour- maline has generally a yellowish or olive-green colour, and is known as “ Ceylon chrysolite.” Fine green crystals are found in Brazil, notably in the topaz-locality of Minas Novas; and when of vivid colour they have been called “ Brazilian emeralds.” Green tour- maline is a favourite ecclesiastical stone in South America Blue tourmaline occurs with the green; this variety is found also at Utö in Sweden (its original locality) and notably near Hazaribagh in Bengal. Certain kinds of mica occasionally contain flat crystals of tourmaline between the cleavage-planes.

Many localities in the United States are famous for tourmaline. Magnificent specimens have been obtained from Mt Mica, near Pans, Maine, where the mineral was accidentally discovered in 1820 by two students, E. L. Hamlin and E. Holmes. It occurs in granite, with lepidolite, smoky quartz, spodumene, &c.; and some of the prismatic crystals are notable for being red at one end and green at the other. Mt Rubellite at Hebron, and Mt Apatite at Auburn, are other localities in Maine which have yielded fine tour- maline. At Chesterfield, Massachusetts, remarkable crystals occur, some of which show on transverse section a triangular nucleus of red tourmaline surrounded by a shell of green. Red and green tourmalines, with lepidolite and kunzite, are found in San Diego county, California. Fine coloured tourmalines occur at Haddam Neck, Connecticut; and excellent crystals of black tourmaline are well known from Pierrcpont, New York, whilst remarkable brown crystals occur in limestone at Gouverneur in the same state. Canada is rich in tourmaline, notably at Burgess in Lanark county, Ontario, and at Grand Calumet Island in the Ottawa river. Heemskirk Mountain, Tasmania, and Kangaroo Island, South Australia, have yielded fine coloured tourmaline fit for jewelry. Madagascar is a well-known locality for black tourmaline in large crystals.

Many varieties of tourmaline have received distinctive names, some of which are noticed above. Dravite is G. Tschermak’s name for a brown tourmaline, rich in magnesia but with little iron, occurring near Unter Drauburg in the Drave district in Carinthia. Taltalite was a name given by 1. Domevko to a mixture of tourmaline and copper ore from Taltal in Chile. The colourless Elba tourmaline was called apyrite by T. F. L. Hausmann, in allusion to its refractory behaviour before the blow-pipe; whilst a black iron-tourmaline from Norway was termed aphrazite by J. B. d’Andrada, in consequence of its intumescence when heated. (F. W. R.\*)

**TOURNAI** (Flemish *Doornik),* a city of Belgium, in the province of Hainaut, situated on the Scheldt. Pop. (1904), 36,744. Although in the course of its long history it has undergone many sieges and was sacked at various epochs by the Vandals, Normans, French and Spaniards, it preserves many monuments of its ancient days. Among these is the cathedral of Notre-Dame, one Of the finest and best preserved Romanesque and Gothic examples in Belgium (for plan, &c., see Architecture: *Romanesque and Gothic in Belgium).* Its foundation dates from the year 1030, while the nave is Romanesque of the middle of the 12th century, with much pointed work. The transept was added in the 13th century. The first choir was burned down in 1213, but was rebuilt in 1242 at the same time as the transept, and is a superb specimen of pointed Gothic. There are five towers with spires, which give the outside an impressive appearance, and much has been done towards removing the squalid buildings that formerly con- cealed the cathedral. There are several old pictures of merit, and the shrine of St Eleu there, the first bishop of Tournai in the 6th century, is a remarkable product of the silversmith’s art. The belfry on the Grand Place was built in 1187, partly reconstructed in 1391 and finally restored and endowed with a steeple in 1852. The best view of the cathedral can be obtained from its gallery. The church of St Quentin in the same square as the belfry is almost as ancient as Notre- Dame, and the people of Tournai call it the “ little cathedral.” In the church of St Brice is the tomb of Childeric discovered in 1655. Among the relics were three hundred small golden models of bees. These were removed to Paris, and when Napoleon was crowned emperor a century and a half later he chose Childeric’s bees for the decoration of his coronation mantle. In this manner the bee became associated with the Napoleonic legend just as the lilies were with the Bourbons. The Pont des Trous over the Scheldt, with towers at each end, was built in 1290, and among many other interesting buildings there are some old houses still in occupation which date back to the 13th century. On the Grand Place is the fine statue of Christine de Lalaing, princess d’Epinoy, who defended Tournai against Parma in 1581. Tournai carries on a large trade in carpets (called Brussels), bonnet shapes, corsets and fancy goods generally. With regard to the carpet manufactory, it is said locally to date from the time of the Crusades, and it is presumed that the Crusaders learnt the art from the Saracens.

The history of Tournai dates from the time of Julius Caesar, when it was called *ciυitas Nerviorum* or *castrum Turnacum.* In the reign of Augustus, Agrippa fixed the newly mixed colony of Suevi and Menapii at Tournai, which continued throughout the period of Roman occupation to be of importance. In the 5th century the Franks seized Tournai, and Merovaeus made it the capital of his dynasty. This it remained until the subdivision of the Frank monarchy among the sons of Clovis. When feudal possessions, instead of being purely personal, were vested in the families of the holder after the death of Charlemagne, Tournai was specially assigned to Baldwin of the Iron Arm by Charles