Cornish copper mines, especially in the neighbourhood of Redruth: it is also found as small, brilliant crystals *very* rich in faces in the white crystalline dolomite of the Binnenthal in the Valais, Switzer­land, and under the name binnite was long considered as a distinct species. (L. J. S.)

**TETRAHEDRON** (Gr. τέτpα-, four, *êδpa,* face or base), in geometry, a solid bounded by four triangular faces. It conse­quently has four vertices and six edges. If the faces be all equal equilateral triangles the solid is termed the “ regular ” tetrahedron. This is one of the Platonic solids, and is treated in the article Polyhedron, as is also the derived Archimedean solid named the “ truncated tetrahedron ”; in addition, the regular tetrahedron has important crystallographic relations, being the hemihcdral form of the regular octahedron and conse­quently a form of the cubic system. The bisphenoids (the hemihedral forms of the tetragonal and rhombic bipyramids), and the trigonal pyramid of the hexagonal system, are examples of non-regular tetrahedra (see Crystallography). “ Tetra­hedral co-ordinates ” are a system of quadriplanar co-ordinates, the fundamental planes being the faces of a tetrahedron, and the co-ordinates the perpendicular distances of the point from the faces, a positive sign being given if the point be between the face and the opposite vertex, and a negative sign if not. If (w, *v, w,* *t*) be the co-ordinates of any point, then the relation u+v+w+t=R, where R is a constant, invariably holds. This system is of much service in following out mathematical, physical and chemical problems in which it is necessary to represent four variables.

Related to the tetrahedron are two spheres which have received much attention. The “ twelve-point sphere,” dis­covered by P. Μ. E. Prouhet (1817-1867) in 1863, is somewhat analogous to the nine-point circle of a triangle. If the per­pendiculars from the vertices to the opposite faces of a tetrahedron be concurrent, then a sphere passes through the four feet of the perpendiculars, and consequently through the centre of gravity of each of the four faces, and through the mid-points of the segments of the perpendiculars between the vertices and their common point of intersection. This theorem has been generalized for any tetrahedron; a sphere can be drawn through the four feet of the perpendiculars, and conse­quently through the mid-points of the lines from the vertices to the centre of the hyperboloid having these perpendiculars as generators, and through the orthogonal projections of these points on the opposite faces.

**TETRARCH** *(τeτρapχηs),* the ruler of a tetrarchy, that is, in the original sense of the word, of one quarter of a region. Such were the tetrarchies of Thessaly as reconstructed by Philip of Macedon and of Galatia before its conquest by the Romans (169 b.c.). In later times the title of tetrarch is familiar from the New Testament as borne by certain princes of the petty dynasties which the Romans allowed to exercise a de­pendent sovereignty within the province of Syria. In this application it has lost its original precise sense, and means only the ruler of part of a divided kingdom, or of a district too un­important to justify a higher title. After the death of Herod the Great (4 b.c.) his realm was shared among his three sons: the chief part, including Judaea, Samaria and Idumaea, fell to Archelaus (Matt. ii. 22), with the title of ethnarch (Josephus, *Antiq.,* xvii. 11, 4); Philip received the north-east of the realm and was called tctrarch; and Galilee was given to Herod Antipas, who bore the same title (Luke iii. 1). These three sovereignties were reunited under Herod Agrippa from a.d. 41 to 44. In the same passage of Luke mention is made of Ly- sanias, tetrarch of Abilene near Damascus, in the valley of the Barada.

**TETRASTOÖN** (Gr. τέτpa-, four, and στοά, a portico), the term in architecture given to a rectangular court round which on all four sides is carried a covered portico or colonnade; the same as peristyle *(q.v.).*

**TETRASTYLE** (Gr. τέτpα-, four, and στμλos, a column), the term in architecture given to a portico of four columns which forms the main front of a temple (*q.v.*).

**TETRAZINES,** in organic chemistry, a group of compounds containing the ring system

C·N·N C∙N∙N C·N·C C·N·Ṅ, or Ν-N∙C,or Ñ·N·Ñ;

only derivatives of the first two types are known. The mem­bers of the first series may be prepared by oxidizing osazones *(i.e.* dihydrazones of α-diketones), dihydrotetrazines resulting. Dihydro-derivatives of the second type are formed from hydrazine and imino-ethers (A. Pinner, *Ber.,* 1893, 26, p. 2126; 1894, 27, p. 984); these easily oxidize to the corresponding tetrazines, which are stable towards acids; their dihydro-derivatives, however, are decomposed, the group—NH·NH—being elimi­nated as hydrazine and replaced by oxygen, with consequent formation of the five membered oxybiazole ring. Concentrated acids convert the dihydro-tetrazines into isodihydrotetrazines, thus:—

R·C·NH·NH R·C·NH·N Ñ·N :C-R Ñ·NH·C·R,

the N-alkyl derivatives of which type may be prepared by the action of alcoholic potash and chloroform on aromatic hydra­zines.

Much discussion has circulated about the decomposition of diazo-acetic ester, from which A. Hantzsch and O. Silberrad *(Ber.,* I9θθ, 33∙ P∙ 58) obtained what they considered to be a dihydro­tetrazine, thus:—

CH∙COaR HO2C∙CH∙NiN . HC·NH·N

× χ Ñ:N ∙CH∙CO2H Ñ·NH·CH.

C. Bülow *(Ber.,* 1906, 39, pp. 2618, 4106), however, showed this substance to be an Ñ-aminotriazole, which necessitates the first decomposition product being an acid (I.), the conversion into the

(I.) HO1C∙C∙NH∙NH . .. HO-C·C— N∙NHl

Ñ·N: C∙COlH U ' Ν∙N∖C∙COiH triazole derivative (II.) being due to the ring opening on the addition of the elements of water and then closing again to the five-membered ring with elimination of water again. The decompositions of diazo- acetic ester were then again examined by T. Curtins and his students *(Ber.,* 1907,40, pp. 262,350, 450, &c.), who showed that both triazole and tetrazine derivatives could be obtained from the bisdiazo-acetic acid which is formed by the action of alkali on diazo-acetic ester.

**TETRAZOLES,** in organic chemistry, a group of heterocyclic compounds, capable of existing in two isomeric series (formulae I and 2), although the methods of preparation do not always permit discrimination between the possible isomers. They are prepared by the action of nitrous acid on cyanamidrazone (dicyanophenylhydrazine) and hydrolysis of the resulting nitrile, from which J. A. Bladin by elimination of the phenyl group (by nitration, reduction, &c.) and of carbon dioxide ob­tained free tetrazole, CH4N2; from amidines by the action of nitrous acid, followed by the reduction of the intermediately formed dioxytetrazotic acids with sodium amalgam; from amidoguanidine by diazotization, the diazonium nitrate on treatment with acetates or carbonates yielding aminotetrazole (J. Thiele, *Ann.,* 1892, 270, p. 1); from the action of nitrous acid on phenyl thiosemicarbazide; and by the action of aryl­azoimides on aldehyde hydrazones (0. Dimroth, *Ber.,* 1907, 40, p. 2402). The tetrazoles behave as strong monobasic acids, and arc exceedingly stable. A series of tétrazolium bases (formula 3) have been obtained by H. V. Pechmann *(Bcr.,* 1894, 27, p. 2920) starting from formazyl compounds (formula 4), which are oxidized by means of amyl nitrite and hydrochloric acid. They are strong bases, which in aqueous solution absorb carbon dioxide readily. The free bases have not been isolated, but their salts are well-crystallized solids.

„KT/N:N· a.∕N∙NH \_ t/N:CH RHN—N:CH hKn=CHoγn∖N=CH RN\N:Ñ RN:Ñ

H^rà

(1) , (2) . (3) , (4)∙

**TETSCHEN,** a town of Bohemia, Austria, 83 m. N.N.E. of Prague by rail. Pop (1900) 9692, exclusively German. It is situated at the confluence of the Polzen with the Elbe, on the right bank of the latter river opposite Bodenbach (g.f.), with