

**A TRACT ON
CRYSTALLOGRAPHY**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649436156

A Tract on Crystallography by W. H. Miller

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com

W. H. MILLER

**A TRACT ON
CRYSTALLOGRAPHY**

A TRACT

03

CRYSTALLOGRAPHY

DESIGNED FOR THE USE OF STUDENTS
IN THE UNIVERSITY.

BY

W. H. MILLER, M.A. FOR. SEC. R.S., F.G.S.,
FOREIGN MEMBER OF THE ROYAL SOCIETY OF GÖTTINGEN, CORRESPONDING MEMBER OF THE
ROYAL ACADEMIES OF TURIN, BERLIN AND MUNICH, MEMBER OF THE IMPERIAL
MINERALOGICAL SOCIETY OF ST PETERSBURG, HONORARY MEMBER OF
THE SOCIETY FOR PROMOTING NATURAL KNOWLEDGE IN FREIBURG,
AND PROFESSOR OF MINERALOGY IN THE UNIVERSITY OF CAMBRIDGE

CAMBRIDGE:
DEIGHTON, BELL AND CO.
LONDON: BELL AND DALDY.

1863.

100 h. 37

157. a 49:

Cambridge:
PRINTED BY E. J. CLAY, M.A.
AT THE UNIVERSITY PRESS.



INTRODUCTION.

THE following Tract contains an investigation of the general geometrical properties of the systems of planes by which crystals are bounded, and of the formulæ for calculating their dihedral angles, indices and elements, given without demonstration in the last edition of Phillips' *Mineralogy*, or of equivalent expressions in a more convenient shape. To these have been added some theorems which appeared in the *Philosophical Magazine* for 1857, 1858, and 1859. The last two chapters contain concise investigations of the general properties of crystalline forms by the methods of ordinary and of analytical Geometry. These were suggested by a remarkable paper entitled *Sulla legge di connessione delle forme cristalline di una stessa sostanza*, by the Commendatore Quintino Sella (*Nuovo Cimento*, Vol. IV.). The Tract, therefore, besides containing all the theorems of Mathematical Crystallography usually required in calculating the angles of crystals, their elements, and the symbols of their faces, will form, it is hoped, a useful supplement to the *Mineralogy*, and also to the *Crystallography* published by the author in 1839. The reader is referred to either of these works

for examples, and for an account of the method of using Wollaston's Goniometer.

The angle made by two faces of a crystal will be measured by the angle between normals to the two faces, drawn towards them, from a point within the crystal. The reasons for adhering to this measure of a dihedral angle were given in the *Philosophical Magazine* for May, 1860. It is needless to offer any reasons for retaining the notation, in addition to the remarks made by the late Professor Grailich in his *Krystallographisch-optische Untersuchungen*, p. 6.

The names used in the Mineralogy to designate two of the hemihedral forms of the Prismatic System, and the hemihedral form of the Oblique System, appeared to be inappropriate, and have, consequently, been changed.

CONTENTS.

CHAPTER I.

PROPERTIES OF A SYSTEM OF PLANES

PAGE
1

1. Law according to which a system of planes is constructed. Axes. Parameters. Indices. The symbol of a plane. 2. Angles between the axes and a normal to a plane. Sphere of projection. Poles. 3. Signs of the indices of a pole. 4. Angles which the arcs joining any pole and two of the poles $100, 010, 001$, subtend at the third. 5. Condition that three poles may lie in a great circle. 6. A zone. A zone-circle. The axis of a zone. 7. Poles may always exist in the intersections of two zone-circles. 8. Symbol of a zone-circle passing through two poles, and of the poles in which two zone-circles intersect. 9. Condition that a zone-circle may pass through a pole. 10. To find the poles in a given zone-circle, and the zone-circles passing through a given pole. 11, 12. Anharmonic ratio of four poles in one zone-circle. 13, 14. Having given the symbols of the poles P, Q, R, S , in one zone-circle, and the arcs PQ, PR , to find the arc PS . 15. Having given the arcs $P'Q, P'R, P'S$, where P, Q, R, S are poles in one zone-circle, and the symbols of P, Q, R , to find the symbol of S . 16. Anharmonic ratio of four zone-circles intersecting one another in the same poles. 17, 18. Having given the symbols of the zone-circles KP, KQ, KR, KS , intersecting in the pole K , and the angles PKQ, PKR , to find the angle PKS . 19. Abbreviated notation for the anharmonic ratio of four poles or zone-circles. 20. Having given the symbols of the poles P, Q, R, S , in one zone-circle, and the arcs PQ, RS , to find the arc PR . 21, 22. Change of axes. 23, 24. Change of parameters. 25. The axis of the zone uvw is the diagonal, drawn from the origin, of a parallelo-

	PAGE
<p>pipeds having three of its edges in the axes, and proportional to ua, vb, wc. 26. Crystals; their faces and cleavage planes. Measure of the dihedral angle between two faces. 27. Arrangement of crystals in systems. 28. Forms. Holohedral and hemihedral forms. Combinations.</p>	

CHAPTER II.

CUBIC SYSTEM	20
------------------------	----

29. Axes and parameters. 30—32. Laws of symmetry of holohedral and hemihedral forms. 33. Position of any pole. 34. Arc joining any two poles. 35. Angles subtended by the arcs joining any pole and two of the poles 1 0 0, 0 1 0, 0 0 1, at the third. 36—38. Arrangement of poles of holohedral and hemihedral forms. 39—52. Figures and angles of different forms. 53, 54. To find the indices of a form.

CHAPTER III.

PYRAMIDAL SYSTEM	29
----------------------------	----

55. Axes and parameters. 56—60. Laws of symmetry of holohedral and hemihedral forms. 61—63. To find the position of any pole. 64—67. Arrangement of the poles of holohedral and hemihedral forms. 68—83. Figures and angles of different forms. 84—86. To find the arc joining any two poles. 87, 88. To find the indices of a form. 89—91. To find the element of a crystal.

CHAPTER IV.

RHOMBOHEDRAL SYSTEM	40
-------------------------------	----

92. Axes and parameters. 93—96. Laws of symmetry of holohedral and hemihedral forms. 97—100. To find the position of any pole. 101. Dirhomboidal forms. 102—104. Arrangement of poles of holohedral and hemihedral forms. 105—121. Figures and angles of different forms. 122. To find the arc joining any two poles. 123—125. To find the indices of a form. 126—128. To find the element of a crystal.

CONTENTS.

vii

CHAPTER V.

	PAGE
PRISMATIC SYSTEM	53

129. Axes. 130—133. Laws of symmetry of holohedral and hemihedral forma. 134—136. To find the position of any pole. 137—139. Arrangement of poles of holohedral and hemihedral forma. 140—148. Figures and angles of different forma. 149, 150. To find the arc joining any two poles. 151, 152. To find the indices of a form. 153—156. To find the elements of a crystal.

CHAPTER VI.

OBLIQUE SYSTEM	63
--------------------------	----

157. Axes. 158, 159. Laws of symmetry of holohedral and hemihedral forma. 160, 161. To find the position of any pole. 162. Arrangement of the poles of the holohedral and hemihedral forma. 163—166. Figures and angles of the different forma. 167, 168. To find the indices of a form. 169, 170. To find the arc joining any two poles. 171—173. To find the elements of a crystal.

CHAPTER VII.

ANORTHIC SYSTEM	67
---------------------------	----

174. Forms. 175—179. To find the position of any pole. 180. To find the indices of a form. 181. To find the arc joining any two poles. 182. To find the elements of a crystal.

CHAPTER VIII.

TWIN CRYSTALS	72
-------------------------	----

183. Laws of union of the two individuals constituting a twin crystal. Twin axis. Twin face. 184. Arrangement of the poles of a twin. 185. To find the twin axis. 186. To find the arc joining any poles of each of the two crystals.