

**ON THE STRUCTURE OF LAVAS WHICH HAVE  
CONSOLIDATED ON STEEP SLOPES: WITH  
REMARKS ON THE MODE OF ORIGIN OF  
MOUNT ETNA, AND ON THE THEORY OF  
"CRATERS OF ELEVATION". FROM THE  
PHILOSOPHICAL TRANSACTIONS.-PART II FOR  
1858; PP. 703-786**

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# **SIR CHARLES LYELL**

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*Professor Agassiz  
from the author*

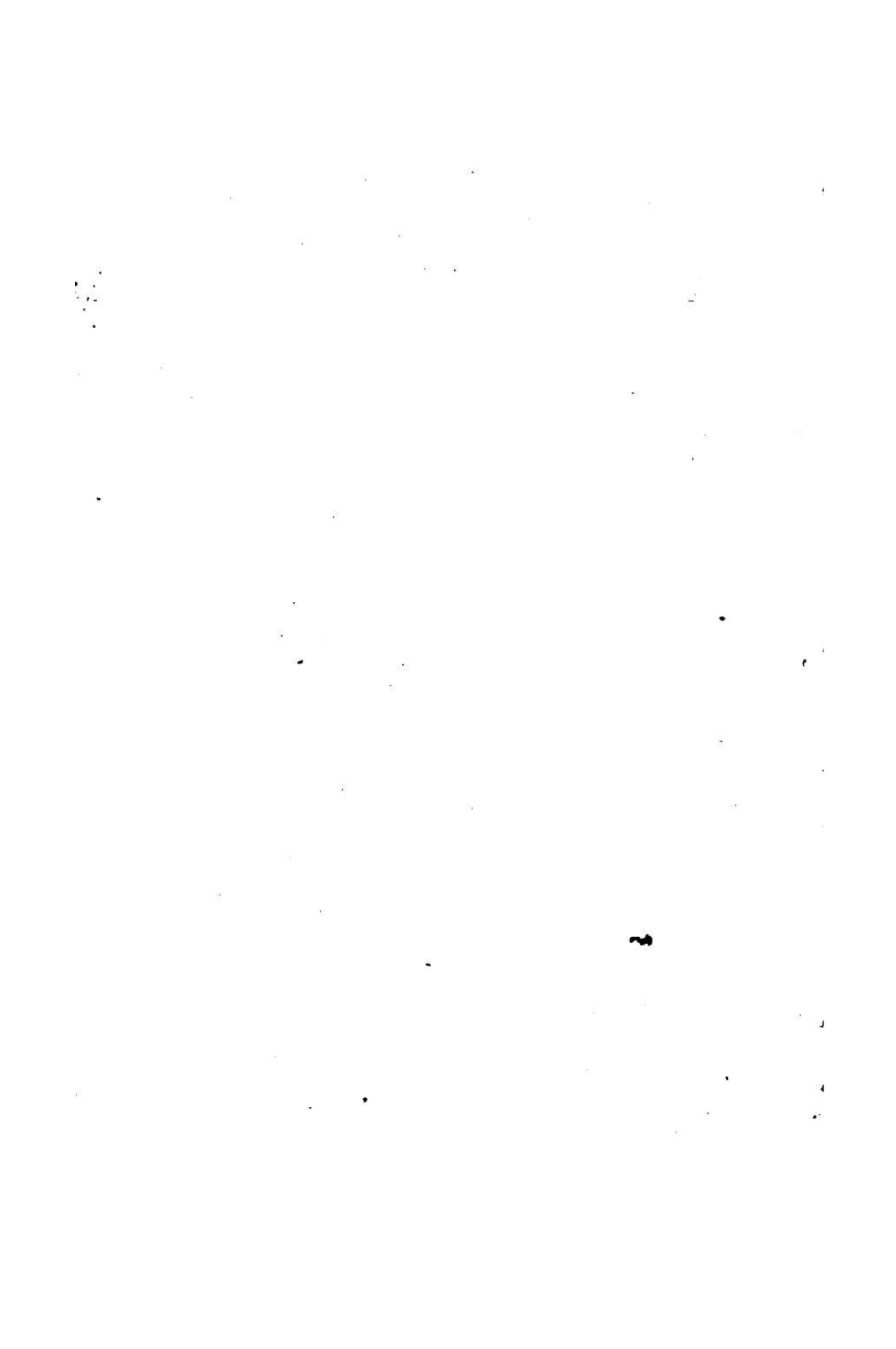
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OF  
M O U N T E T N A  
FORMED ON STEEP SLOPES,  
AND  
ON CRATERS OF ELEVATION.

BY  
SIR CHARLES LYELL, F.R.S., D.C.L.

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*From the PHILOSOPHICAL TRANSACTIONS.—PART II. FOR 1858.*

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XXXII. *On the Structure of Lavas which have consolidated on steep slopes; with Remarks on the Mode of Origin of Mount Etna, and on the Theory of "Craters of Elevation."* By Sir CHARLES LYELL, F.R.S., D.C.L.\*

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\* The double paging of this memoir will enable the reader to refer to the original in the Philosophical Transactions, Part II. vol. cxlviii. for 1858.

† [This paper was read to the Royal Society on the 10th of June, 1858, and a full abstract of it was printed in the 'Proceedings' for that month. In September of the same year I revisited Naples and Sicily, for the sake of re-examining certain points in the geology of Vesuvius and Etna, devoting five weeks to the exploration of the latter mountain. The additional facts and inferences obtained at that time have, by leave of the Council, been embodied in the present memoir; all the newly-intercalated passages being marked by brackets, thus [ ], or such as are simply recasts of the original MS., thus a[ ]b. By comparing the abstract published in June (Proceedings of the Royal Society, June 10th, 1858) last with the present memoir, it will be seen that they agree with each other in all essentials, whether of fact or theory.]

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## PART I.

## ON THE STRUCTURE OF MODERN LAVAS WHICH HAVE CONGEALED ON STEEP SLOPES.

*Preliminary remarks on the characters commonly attributed to lavas which have consolidated on steep slopes, and on the theory of "Craters of Elevation."*

THE question whether tabular masses of lava having a compact and stony texture, and a thickness of many feet, can be formed on slopes inclined at angles of from  $10^{\circ}$  to  $40^{\circ}$ , has of late years acquired considerable importance, since geologists of high authority have assumed that if the inclination exceed  $5^{\circ}$  or  $6^{\circ}$ , a lava-current will be scoriaceous in texture, fragmentary in structure, and insignificant in thickness. Such steeply-inclined currents, it is said, can never give rise to beds of compact rock, comparable to those solid layers which we see, alternating with scoriæ and tuff, in the older parts of volcanic mountains, such as the escarpments of Somma in the case of Vesuvius, or the cliffs surrounding the Val del Bove in the case of Etna.

It has even been laid down as a rule by one geologist of eminence, the late M. DUFRESNOY of Paris, that lavas, to be compact and crystalline, must have consolidated on a slope not exceeding  $1^{\circ}$  or  $2^{\circ}$ . He states, in his memoir on "Vesuvius and its Environs" (1834), "Les laves ne sont compactes et cristallines que lorsqu'elles se sont répandues sur un sol ayant 1 degré à 2 degrés au plus d'inclinaison. . . . Lorsque la pente du terrain est supérieure à  $2^{\circ}$  la texture compacte commence à s'effacer, les laves deviennent bulleuses et même scoriacées. Les coulées, qui se présentent sous un angle de  $4^{\circ}$  ne sont plus que des agglomérations de fragments incohérents\*." M. ELIE DE BEAUMONT, in his

\* "Terrains volcaniques des environs de Naples," Mém. pour servir à une description géol. de France, tome iv. p. 842.