Chamonix are composed of two distinct parts. One part is the uninterrupted and uniform massif which rises up to 7-800 toises above the valley (*first plate*) [facing p. 88 in Vol. I], the other consists of the pyramids or the isolated needles which tower above this massif.

The lower uniform masse consists of foliated rocks of different [H. III. 140] kinds, but mostly quartzose and micaceous. These rocks consist of very regular layers which run, as the valley, from NE to SW; these layers are not much inclined toward the foot of the mountain, but they rise gradually against the valley up to the summit where they are exactly vertical. These same layers approach the nature of granite the nearer they are to the summit of the mountain; and there they change into veined granites or even massive granite enclosed by layers of either veined granite or foliated rock.

The pyramids that tower above this massif consist of granite en masse. They are flanked, or even consist on the outside, of pyramidal leaves which are divided into large beds parallel to the planes of the leaves. The latter are almost vertical and are not rising against the valley as do the lower layers of the massif, but they lean against the pyramidal bodies themselves. Their direction is more or less the same as that of the massive layers. The center [H. III. 141] or the inner part of these pyramids, seem, in some places, to be without any regular structure and to be merely divided by accidental fissures.

Furthermore, one should not imagine that these pyramids are sitting on the massif that they dominate like a column on its base. The direction of the layers shows that the massif is leaning against the pyramids which have their own base and that it might rather be the massif which is partly sitting on the inner bases of the pyramids since the sheets of those descend toward this massif and seem to plunge underneath it."

Hutton's last answer: [H. III. 141]

"Here, in making a distinction of the central mass of granite and the erected strata of various species of alpine schisti, M. de Saussure has been at the utmost pains to inform himself that the central mass which is elevated to such a height, has its basis under those erected strata with which it is immediately connected. Now this could only happen in one of two ways; [H. III. 142] either the alpine schisti were superinduced upon the inclined granite in its present place; or the horizontal strata had been elevated by the rising granite. I suppose M. de Saussure's theory would lead him to conclude the first; mine again leads me to conclude the last."

CONCLUSION

Throughout this paper, we have encountered Hutton's great interest in Saussure's descriptions of the origin, structure, and composition of montains in general, and the Alps in particular. Why were those descriptions of such importance to him? The reason

was obviously related to the public reaction--mostly by Neptunists-- against his first *Theory of the Earth* of 1788. [See Hutton's Vol. I. pp. 201-268] under the heading *Kirwan's objections ...*] This theory had been largely based on Hutton's investigations in the Alpine regions of Scotland, whereas some of his critics were talking about the Alps and various other European mountains.

While Hutton had found reliable proofs for his theory in Scotland, he felt now that he had to compare the Alps--which he had never seen-- with the mountain regions in Scotland. Only then could he convince his critics and the world that his global theory was the one to accept.

Unfortunately, he was unable to travel during his last years and thus had to refer to Saussure's well-known descriptions in *Voyages dans les Alpes*. The reading of the first two volumes of that famous work became his major occupation. With relatively little time at his disposal to accomplish all the reading and restructuring of his last two volumes, I believe that he became more and more obsessed in his goal to convince his audience that his theory was entirely acceptable.

ACKNOWLEDGMENTS

The author is very grateful to her husband Albert V. Carozzi for his constant help and advice in this comparative work on two challenging naturalists.

REFERENCES

BESSON, A. Ch. 1780. *Discours sur l'histoire naturelle de la Suisse. In* Zurlauben, B. F. *Tableaux topographiques*, Bd. 1 , pp. I-LXXXXIV, Paris.

BOURGUET, Louis. 1729. *Lettres philosophiques sur la formation des sels et des crystaux et sur la géneration & et le méchanisme organique des plantes et des animaux : A l'occasion de la pierre belemnite et de la pierre lenticulaire, avec un Mémoire sur la théorie de la terre.* Amsterdam, chez François l'Honoré.

CAROZZI, A. V. 1996. New historical data on H.-B. de Saussure's introduction of the terms *Moraine* (1764), *Roches Moutonnées* (1776), and *Serac* (1688) to Geology. *Journal of Geoscience Education*, v. 44, pp. 169-174.

CAROZZI, A.V. 1998. *Découverte d'une grande découverte : Horace-Bénédict de Saussure et les refoulements horizontaux en sens contraire dans la formation des Alpes.* In *Les plis du temps : mythe, science et H.-B de Saussure.* Sous la responsabilité d'Albert V. Carozzi, Bernard Crettaz, David Ripoll. Musée d'Ethnographie, Annexe de Conches, Genève; Conservatoire d'Art et d'Histoire de Haute-Savoie, Annecy, France, pp. 223-367.

Dictionnaire Géographique, Historique et Politique de la Suisse avec une carte Géographique. Nouv. Ed. , corrigée et augmentée. Genève 1777, Imprimerie de Nouffert et Bassompierre. 2 v.

HUTTON, James. 1788. *Theory of the Earth; or an Investigation of the Laws observable in the Composition, Dissolution, and Restoration of Land upon the Globe*, read at the Royal Society of Edinburgh (March and April) in 1785. *Trans. Royal Soc. Edinburgh.* Vol. I, pp. 209-304. Facsimile reprint. Contributions to the History of Geology, Hafner Publishing Company, Darien, Connecticut. 1970, v. 5, pp. 51-103.

HUTTON, James. 1795. *Theory of the Earth, with Proofs* and *Illustrations.* 2 Vols. Edinburgh: Printed for Cadell, jr., and Davies, London, and W. Creech, Edinburgh. Facsimile reprint. Engelmann (Cramer) and Wheldon & Wesley, Ltd., Codicote/Herts. 2 v. 1960.