



Fig. 9. Density and refractive index of SiO_2 phases. \blacktriangle Solid triangle: crystalline phases—Coe, coesite; Q, quartz; K, keatite; C, cristobalite; T, tridymite; M, melanophlogite. \bullet Solid circle: fused silica glass. \circ Open circle: diaplectic silica glasses (Ries). \square Dotted square: diaplectic quartz with planar elements of the decorated type (Ries). \square Open square: diaplectic quartz with planar elements of the non-decorated type (Ries).

pressures (> 350 kb). Figure 9 shows the densities and mean refractive indices of these SiO_2 -glasses and of quartz with planar elements from Ries samples. These shock-produced phases are distinctly different, in their physical properties, from both α -quartz and from fused silica. We propose to call them *diaplectic quartz* (quartz with planar elements) and *diaplectic quartz glass*, respectively (Engelhardt and Stöffler, *this vol.*, p. 159; Engelhardt *et al.*, 1967a).

Further investigations are desirable in order to elucidate the similarities and differences which exist between planar elements found in quartz from impact craters and deformation features which have been artificially produced by static high pressure experiments (Christie *et al.*, 1964; Carter *et al.*, 1964; Carter, 1965; Christie, *this vol.*, p. 624).

ACKNOWLEDGMENTS

One of the authors (W. v. E.) expresses his thanks to the Dominion Observatory, Ottawa,

and especially to Dr. M. J. S. Innes and to Mr. M. R. Dence for the opportunity of working with the rock specimens from the Clearwater Lake drill holes. Thanks are also due to Prof. Dr. H. Haselmann, Dr. F. Habermalz and Dipl. Phys. J. Rienitz, Tübingen, for their help with the interference microscope. The authors thank the Deutsche Forschungsgemeinschaft for financial support.

REFERENCES

- Bunch, T. E., and A. J. Cohen, Coesite and shocked quartz from Holleford crater, Ontario, Canada, *Science*, *142*, 379-381, 1963.
- Bunch, T. E., and A. J. Cohen, Shock deformation of quartz from two meteorite craters, *Bull. Geol. Soc. Am.*, *75*, 1263-1266, 1964.
- Carter, N. L., Basal quartz deformation lamellae—a criterion for recognition of impactites, *Am. J. Sci.*, *263*, 786-806, 1965.
- Carter, N. L., J. M. Christie and D. T. Griggs, Experimental deformation and recrystallization of quartz, *J. Geol.*, *72*, 687-733, 1964.
- Christie, J. M., Deformation of quartz in static tests and

- its relevance for interpretation of impact textures, *this vol.*, p. 624.
- Christie, J. M., H. C. Heard and P. N. La Mori, Experimental deformation of quartz single crystals at 27 to 30 kbar confining pressure and 24°C, *Am. J. Sci.* **262**, 25-55, 1964.
- Dence, M. R., A comparative structural and petrographic study of probable Canadian meteorite craters, *Meteoritics*, **2**, 249-270, 1964.
- Dence, M. R., The extraterrestrial origin of Canadian craters, *Ann. N. Y. Acad. Sci.* **123**, 941-969, 1965.
- Engelhardt, W. v., J. Arndt, D. Stöffler, W. F. Müller, H. Jeziorkowski, and R. A. Gubser, Diaplektische Gläser in den Breccien des Ries von Nördlingen als Anzeichen für Stosswellenmetamorphose, *Contr. Mineral. Petrol.* **15**, 93-102, 1967a.
- Engelhardt, W. v., W. Bertsch, D. Stöffler, P. Groschopf, and W. Reiff, Anzeichen für den meteoritischen Ursprung des Beckens von Steinheim, *Naturwiss.*, **54**, 198-199, 1967b.
- Engelhardt, W. v., and D. Stöffler, Spaltflächen in Quarz als Anzeichen für Einschläge grosser Meteoriten, *Naturwiss.*, **52**, 489-490, 1965.
- Engelhardt, W. v., and D. Stöffler, Stages of shock metamorphism in crystalline rocks of the Ries Basin, Germany, *this vol.*, p. 159.
- Robertson, P. B., M. A. Vos and M. R. Dence, Deformation in rock forming minerals from Canadian craters, *this vol.*, p. 433.
- Stöffler, D., Zones of impact metamorphism in the crystalline rocks of the Nördlinger Ries crater, *Contr. Mineral. Petrol.* **12**, 15-24, 1966.