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A RETRACTION OF THE REPORT OF A LYOTROPIC CHOLESTERIC BLUE PHASE

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An error was made in assigning the blue phase structure to platelets of 16.3 wt % disodium cromoglycate, 26.1 wt % allo-4-hydroxy-*l*-proline and water, at $T = 34^\circ\text{C}$. Microscopic observations show the above mentioned platelets to be batonnets of a reentrant middle soap.

In a recent Note¹ the appearance of a blue phase in mixtures of disodium cromoglycate (DSCG), allo-4-hydroxy-*l*-proline (HCLP) and water was reported.

The present Letter presents a more careful observation of the above system with attention to the following specific physical properties of the blue phase.

(1) The blue phase is isotropic in accordance with a (three-dimensional space lattice) periodic texture of the director field.^{2,3} Transmitted light experiences no net optical rotation on traversing the sample. Deviations from zero birefringence may be caused by strain induced in the blue phase lattice through boundary conditions, temperature or concentration gradients, etc., and/or from form birefringence.⁴ The form birefringence will be present in a system of oriented rectangular crystallites, and is due to the difference in density of isotropic and blue phases.²

(2) The blue phase exhibits selective reflection at different wavelengths.^{2,3} The different wavelengths are related by Miller indicies, and the symmetry of the

lattice can be deduced.

(3) Crystals of blue phase, or platelets, represent a macroscopic manifestation of the microscopic structure.³

In Ref. (1) the observation of "platelets" were taken as a characteristic sign of the blue phase. The platelets were reported to be invariant in color upon stage or crossed polar rotation. Reinvestigation has shown this to be incorrect; in fact, the colors of the "platelets" are indeed observed to change upon rotation of the crossed polars implying a definite orientation of the optic axis throughout the "platelet".

The above observations are most simply explained as coinciding with the properties of batonnets of reentrant middle soap (hexagonal ordering of cylinders of DSCG⁵ within the batonnet), as shown in Fig. 1.

It is well known that the middle soap phase can occur above and below the temperature region containing a nematic phase^{6,7} in DSCG systems. In Fig. 2 we plot the phase diagram⁸ for the DSCG-water system (see also Ref. (7)). Even without the addition of proline, large two phase regions are evident.

We made a fresh sample as per Ref. (1): 16.3 wt % DSCG/26.1 wt % HCLP/water. This sample (volume $\approx 1 \text{ cm}^3$) was stirred magnetically for ~ 48 hours within a homogeneous phase to minimize concentration gradients. Flat glass capillaries, thickness .3 mm, were filled and carefully sealed with a torch. At $T \approx 37^\circ\text{C}$ we observed by microscope four coexisting phases: solid needle-like crystals, middle soap, nematic, and isotropic.

Examples of textures obtained in this region of the phase diagram indicate that a rich array of structures

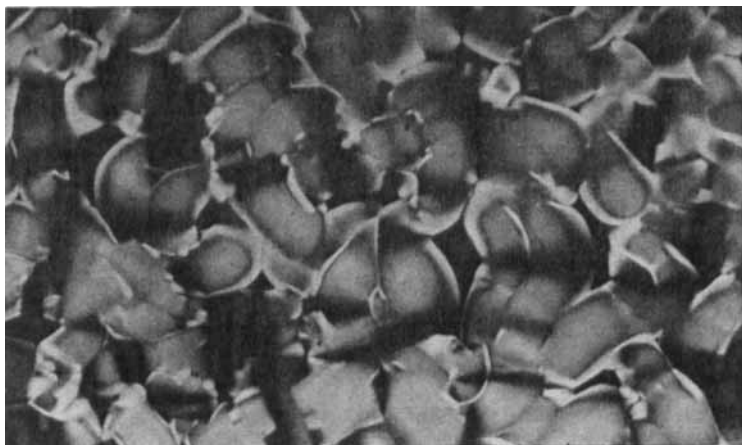


Fig. 1: Batonnets of 16.3 % DSCG, 26.1 % HCLP, water; 34°C, magnification, 200X.

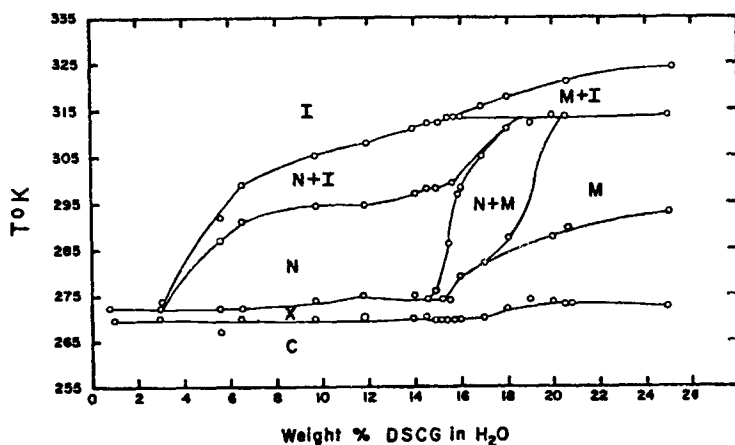


Fig. 2: Phase diagram of DSCG-H₂O as determined by differential scanning calorimetry at a scan rate of 20°/minute. Reproduced from Ref. (8).

are available to the system. Fig. 3 shows an observed parabolic focal conic texture,⁹ and Fig. 4 a fingerprint texture.

We also note here that after a period of \sim two weeks the bulk sample used in Fig. 1 turned a dark brown color. We are currently studying the chemistry of DSCG-amino acid interactions.

In conclusion, we have shown the "blue phase platelets" of Ref. (1) are actually batonnets of middle soap.

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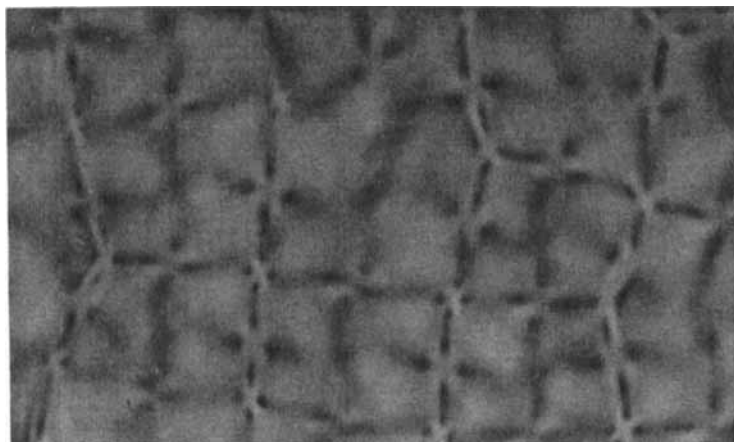


Fig. 3: Parabolic focal conic texture in 14 % DSCG, 16.4 % 4-transhydroxy- ℓ -proline, 13 % d(+)-glucose, water; 8°C, magnification, 200 X.

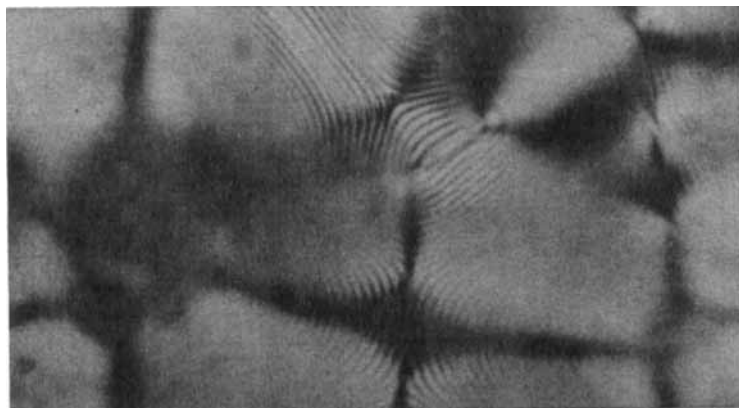


Fig. 4: Remnants of fingerprint texture in 14 % DSCG, 8.0 % d-alanine, 2.0 % ℓ -proline, water; 10°C, magnification, 200 X.