Table 4. Optical properties of ureyite. Indices for Na light: strongly pleochroic, with X, dark green; Y, yellow-green to yellow; Z, emerald-green to dark emerald-green. Optically negative, 2V 60°–70° (Toluca).

Meteorite	α	β	γ	$\alpha \wedge c$
Coahuila	1.748±.001	1.756±.001	1.765±.001	14°±1°
Toluca	1.740±.001	1.756±.002	1.762±.001	22°±1°
Hex River Mountains	Mean index about 1.760			
$NaCrSi_2O_6$ (synthetic)	1.766±.002		1.781±.002	8°

aegirine, $NaFeSi_2O_6$, to aegirine-augite, $(Na,Ca)(Fe^{3+},Mg,Fe^{2+},Al)Si_2O_6$. The largest variation in properties and composition was found in the Toluca material. The aegirine-augite series, as in the series extending from $NaCrSi_2O_6$, is accompanied by an increase in a_0 and b_0, by a decrease in the indices of refraction, and an increase in the extinction angle $\alpha \wedge c$. Crushed grains of ureyite exhibit a well-defined cleavage on (110) and a pronounced parting on (001). The cleavage angle was measured on a reflecting goniometer as 87°23′ ± 10′. The hardness and density could not be determined; the density for synthetic $NaCrSi_2O_6$, calculated with the cell dimensions of Table 2, is 3.60. Calculated density values for other synthetic members of the jadeite group are given in Table 2.

The mineral here described recalls an ill-defined emerald-green chromium mineral found in Toluca and described under the name kosmochlor by Laspeyres (*8*) in 1897. His analysis of a sample stated to contain a few percent of impurities gave: MgO, 4.55; CaO, 6.06; Fe_2O_3, 9.09; Al_2O_3, 9.09; Cr_2O_3, 39.39; SiO_2, 31.82; total, 100.00. The determinations were made with the greatest care, but the total sample weighed only 3.3 mg and the analysis, based on gravimetric methods, must be considered doubtful. Sodium, if present, would not have been detected since the sample was brought into solution by fusion in Na_2CO_3. Laspeyres described the mineral as forming cleavage laths bounded by a perfect cleavage on (010), a less-perfect cleavage at right angles on (100), and a third cleavage, observed as a single surface, in the same zone at about 105° to (010). On (010), the mineral exhibited inclined extinction with $\alpha \wedge c$ about 12°. The absorption of X is light yellow-green, and at right angles thereto, dark blue-green to emerald-green. The chemical and other characters of this mineral do not immediately indicate an identity with or relation to $NaCrSi_2O_6$. The optical behavior, however, suggests that the measurements may have been made on a cleavage flake of a clinopyroxene resting on (110) [with 110 $\wedge$ 110 $\sim$ 87°]. We observed a green variety of diopside in the residues of Toluca, but the Cr_2O_3 content was only about 1 percent.

Acting with the approval of the Commission on New Minerals and Mineral Names of the International Mineralogical Association, we have set aside Laspeyres's name "kosmochlor," insofar as it may relate to this matter, since its identity with $NaCrSi_2O_6$ could only be fortuitous. The name itself is undesirable because of the ambiguity deriving from the suffix *chlor*, which can mean chlorine-containing or, as was here the intent, green. The name ureyite, after Harold Clayton Urey, Nobel Laureate in chemistry and noted investigator of meteorites, is here proposed for $NaCrSi_2O_6$.

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Subbottom Profile of Abyssal Sediments in the Central Equatorial Pacific

Abstract. *A north-south subbottom acoustic profile made in the central Pacific Ocean shows that the first layer (unconsolidated and semiconsolidated sediments) increases in thickness from less than 200 meters at about 14°N to more than 600 meters near the equator. Two major faults, one of which lies on the extension of the Clipperton fracture zone, have produced vertical separations of about 400 meters in the base of the first layer.*

During the recent WAHINE expedition we ran a subbottom acoustic profile (*1*) along longitudes 153° and 148°W from almost 14°N to the equator (Fig. 1). This profile yielded a detailed picture of the north-south variations in thickness of the first layer (*2*), as well as information on its internal structure.

The area surveyed is floored by a diverse suite of abyssal sediments made up of biogenous, authigenic, volcanic, and terrigenous components. Distribution of these various fractions is influenced by many physical and biological factors which, in terms of geologically significant time intervals, are far from constant.

Studies of bottom cores from the central and eastern Pacific led Arrhenius (*3*) and Riedel (*4*) to conclude that the equatorial belt of high organic productivity became narrower and narrower throughout the Tertiary period. Shor (*5*) used seismic reflection data from the eastern equatorial Pacific to show that the thickness of sediments above the "second layer" decreases with distance from the equator; this layer is generally assumed to consist of volcanic material or indurated sediments (*6*).

Our Arcer traverse crossed an area of abyssal hills far removed from major sources of terrestrial sediments. The area was selected because it lies within the "most normal" portion of the Pacific basin (*6*); it was hoped that major tectonic features associated with the Darwin and East Pacific rises (*6*) would not be present to influence the processes of sedimentation. In fact, at least two large faults were crossed (see Fig. 2), one of which lies on the westward extension of the Clipperton fracture zone about 900 km beyond the previously recognized limit of surface expression of this feature (*6*).

The general thickness and structure of the sediment prism from 13°45′N to the equator are shown in Fig. 2. The depths to subbottom reflectors have been calculated by using a value of 2 km/sec for the velocity of sound in first-layer sediments; this value may be low by about 10 percent (*2*) but, since no velocity determinations were made during the traverse, the inclusion of a second significant figure does not seem justified. Figure 3 illustrates the type of Arcer records obtained during the traverse.

The section from 13°45′N to the northern fault (Figs. 2 and 3*A*) is consistently thinner than 220 m and includes only one continuous reflector above "basement" ("basement" denotes the deepest persistent reflector present on the Arcer records; it is assumed to be at the top of the second layer of Raitt (*2*) and is so indicated in Fig. 3). Other reflectors, locally quite strong, do not persist for more than a few kilometers.

The northern fault has produced a vertical separation of basement of almost 400 m (south side is the higher). A piston core taken on the fault scarp contained reworked (corroded) Radiolaria of Eocene age. The fault has had little apparent effect on the sediment section to the north, but the section on the south side thins markedly toward it. Additional work is required to determine whether this fault is genetically related to the Clarion fracture zone, which lies some 250 km to the north.

Between 11° and 6°N (Fig. 3*B*), the first layer varies in thickness from about 200 to 300 m; the variation does not seem to be systematically related to latitude and may be more strongly influenced by bottom topography. From 6°N to the Clipperton fault (3°30′N) the layer gradually thickens to about 400 m.

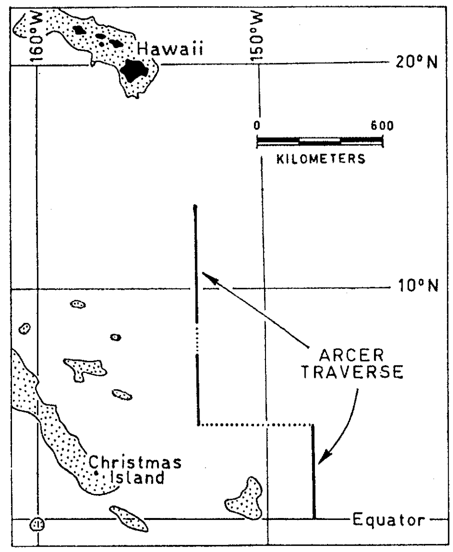

Fig. 1. Ship's track; heavy lines indicate extent of subbottom profiles. Water depths in stippled areas are less than 4 km.

Identification of the second layer between 7° and 4°N is open to some doubt. The horizon so labeled in Fig. 3*B* is the deepest reflector consistently present. In a number of places, however, very weak returns, generally persisting for less than 0.1 km, can be recognized from below this layer; they may be side echoes or real reflections from within the second layer, or their source may correspond to the surface of Raitt's "second layer" (*2*). The third explanation is consistent with Shor's Fig. 6 (*5*), which shows the first layer reaching a maximum thickness of 0.5 km in the vicinity of 4° to 5°N; in this case our basement may correspond to Shor's "first reflection."

The Clipperton fault has produced a vertical separation of basement of 470 m (south side is the higher). Strata to the north abut the fault scarp without visible deformation or change in acoustic properties, suggesting that the scarp is a feature of considerable antiquity and that little if any movement occurred along it while the first layer was being deposited. Sediments to the south show a 50-percent decrease in thickness over the basement high; the continued existence of this high throughout the period of deposition of the first layer is inferred from the uniform pinching-out of all strata in the sedimentary section.

From the Clipperton fault to the equator the first layer gradually thickens to a maximum of 630 m (Figs. 2 and 3*C*). The basement surface is irregular on a small scale, and there are no coherent reflections from greater depths. Three strong reflectors can be followed for most of the 350 km covered by this segment of the traverse, while two or three other reflectors can be traced over distances up to 100 km. Superimposed on the regional structure we describe is a complex local structure of abyssal hills and small basins which are too small to appear in Fig. 2.

We observed no evidence of regional discordances between basement and shallower reflectors within each of the four long segments of continuous, structurally undisturbed section. New reflectors originate near the surface rather than at the bottom of the first layer. However, basement cannot be positively correlated across the major faults, nor between 8°24′N and 7°N where there is a gap in our records.

It should be noted that the gradual shoaling of the ocean floor between 14°N and the equator is only partly accounted for by an increase in the thickness of sediments; the basement reflector also becomes shoaler relative to sea level. This fact contrasts with the situation further east, at about 125°W, where the observed north-to-south shoaling can be entirely accounted for by an increase in the thickness of the first layer (*5*).

We have calculated the approximate

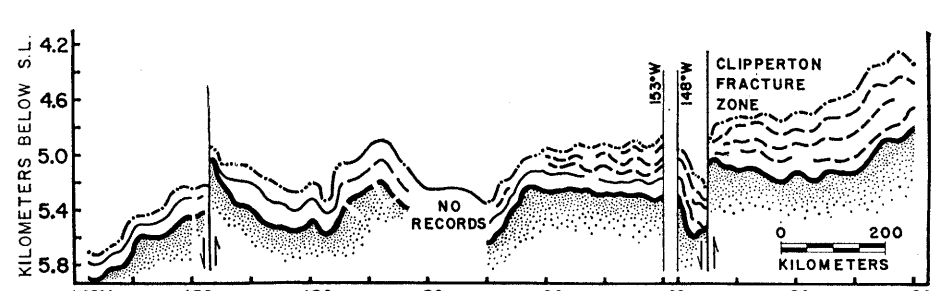

Fig. 2. Generalized north-south profile constructed from Precision Depth Recorder and Arcer records. Water depths are corrected for the velocity of sound in water (*10*); subbottom depths are based on a sound velocity of 2 km/sec in first-layer sediments. Solid lines indicate strong reflectors; dashed lines, weaker reflectors. The deepest reflector is assumed to be the top of the second layer.

Table 1. Estimated times required for accumulation of the first layer.

Segment of traverse	Type of sediment	Approx. thickness (m)		Deposition	
		Present	Precompaction*	Rate (m/10^6 yr)	Duration ($\times 10^6$ yr)
14° to 12°N	Siliceous clay	200	300 to 350	0.4 to 2	150 to 900
11° to 6°N	Siliceous ooze	300	350 to 500	1 to 4	90 to 500
5° to 3°N	Calcareous siliceous ooze	400	450 to 650	2 to 8	60 to 300
2° to 0°N	Calcareous ooze	600	680 to 700	5 to 30	23 to 140

* Interpolated from Hamilton's tables 3 and 4 for "clay-shale" and "*Globigerina* ooze" (*11*).

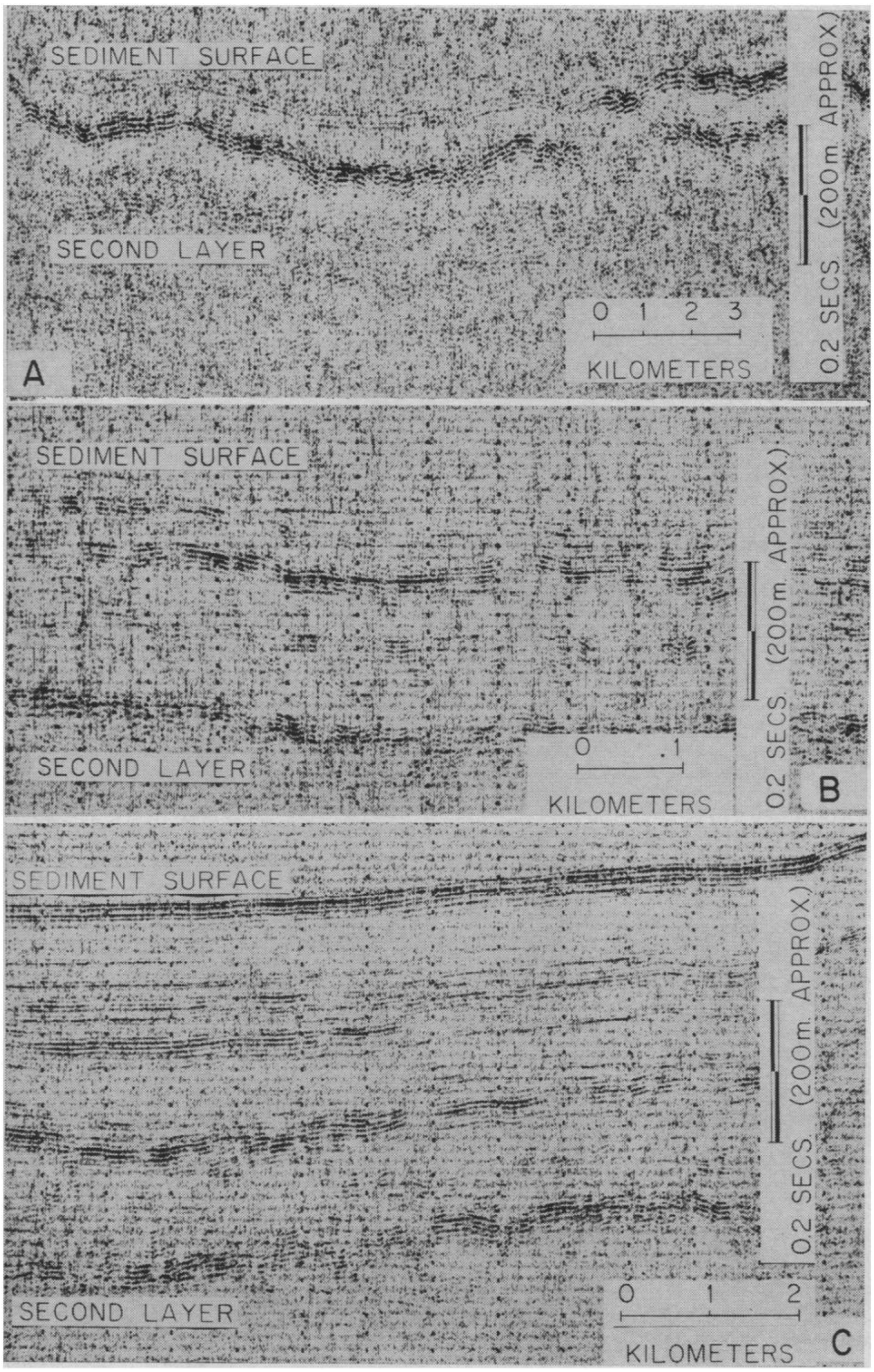

Fig. 3. Typical Arcer records showing the gradual increase in thickness of the first layer from higher to lower latitudes. *A*, 13°20'N, 153°W; *B*, 6°N, 153°W; *C*, 0°55'N, 148°W.

time interval required for deposition of the first layer at several points along the traverse (Table 1). Estimates of rates of sedimentation are based on ionium-thorium determinations for abyssal clays (*7*) and on carbon-14 determinations for calcareous ooze (*8*). Attempts to correlate these two methods have not been very successful (*9*); we have no reason to prefer one or the other and have tried to make our range of estimates for each segment of the traverse large enough to absorb possible discrepancies. No great accuracy is claimed for the calculated durations because values for the degree of compaction of, the velocity of sound in, and the rate of accumulation of first-layer sediments are either not well known or are of doubtful validity when extrapolated beyond the upper Tertiary part of the section.

Nevertheless, differences between segments of the traverse are great enough to suggest one or more of the following possibilities: (i) basement, in the sense that we have used it, is not isochronous; (ii) rates of sedimentation in the past were markedly different from those prevailing today; and (iii) the distribution of types of sediment at depth is significantly different from that known at the surface.

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