depth, and there are pronounced discontinuities at depths of 1 m, 1.8 m and 3 m. Sediments rich in organic carbon, between 18 cm and 67 cm and between 76 cm and 83 cm, also show short period fluctuations in $^{13}C/^{12}C$, but with an overall trend towards ^{13}C enrichment in the younger samples.

Deuser believes that the uniformity of ^{18}O content in most of the core arises as a result of redeposition, mixing and ion exchange. By comparison, the exchange of carbon isotopes would take place more slowly, because in the carbonate carbon can only be exchanged together with the coordinated oxygen atoms, whereas single oxygen atoms can exchange without affecting the carbon. So the carbon profiles probably provide the more accurate detailed history of changes affecting the Black Sea, although the oxygen evidence clearly points to a dramatic change in conditions beginning roughly 9,000 yr BP.

Salinity changes are, of course, an obvious principal cause of changes in the isotope balance. From the isotope evidence and other studies of sedimentary changes a picture of the history of the Black Sea since the most recent glaciation now emerges. For some time before 17,000 yr BP until 9,000 yr BP the "sea" was a freshwater lake isolated from the world's oceans. Rather than salt water entering from the Mediterranean, there may have been spillage of freshwater from the lake across the Bosporus from time to time. From roughly 15,000 yr BP the worldwide sea level began to rise (J. D. Milliman and K. O. Emery, *Science*, **162**, 1121 ; 1968) and reached the level of the Bosporus sill roughly 9,000 yr BP. Salinity then built up in the Black Sea until present day levels were reached, roughly 3,000 years ago, and the sea has now settled down to a stable salinity level.

CEN X-3

Peculiar Binary

by our Cosmology Correspondent

THE binary nature of Cen X-3 seems to have been confirmed, and details of the structure of the individual components of the system are now emerging. E. Schreier and colleagues of American Science and Engineering Inc. have now reported an analysis of data on this source which are the result of a year's observations from the Uhuru satellite (*Astrophys. J. Lett.*, **172**, L79; 1972). As well as the 4.8 s pulsation period found earlier, it is now clear that Cen X-3 changes in a regular way over a period of about 2 days, and that the exact period of the ~4.8 s variation is affected by this second regular change in intensity.

From the data covering 1971 the AS&E group have found that the source can appear at either of two levels of intensity, and that the transition between these levels takes roughly one hour. In May 1971 they were able to obtain a continuous, detailed set of observations over a period of one week. With these data as a guide, they have been able to pick out the regular ~2 day period for the variations between the two states throughout the year's data. The 4.8 s period itself is subject to variations of about 0.02 s on successive days. The average period is 4.842 s and usually the period is between 4.832 s and 4.853 s. Overall, Schreier and colleagues summarize their observations as evidence that:

- Two distinct average intensity levels differ by a factor of ten and repeat with a period of 2.08710 ± 0.00015 day.
- The low level sometimes persists for several days, but the high level is never found when the low level is predicted.
- The 4.842 s period shows a sinusoidal variation of period with null points of the variation coinciding with the centres of the high and low states of intensity to within 0.003 ± 0.006 day.

This evidence points to an occulting binary system in which the short period pulsations come from a compact object orbiting a much larger object. The variations in the ~4.8 s period can then be interpreted as a result of the Doppler effect. Because the object associated with the intense X-ray emission must be very small on any conventional understanding of the mechanism causing the pulsations its mass is probably no more than 1 $M_\odot$, which suggests that the companion is a giant with mass between 17 $M_\odot$ and 46 $M_\odot$. But although a massive main sequence star or a B0 supergiant seems a suitable candidate for the central object on the face of the mass and radius requirements, the possibility remains that a more compact object with an extended atmosphere could also fill the role.

These observations are bound to stimulate further optical surveys of the region—Cen X-3 is now known to lie at RA 11 hr 19 m $\pm$ 0.4 m, dec. —60° 19′.2 $\pm$ 3′—but Schreier and his colleagues caution that the system is probably dominated optically by the central massive object, and that it is unlikely that either of the two periods reported will be detected photometrically.

This work suggests that there may be a class of X-ray sources which are associated with binary systems. It has already been shown that the X-ray source Cyg X-1 is a binary system with a period of 5.6 days and there is also evidence which indicates that a pulsating X-ray source in Hercules also shows two intensity levels which resemble those shown by Cen X-3.

More about RD 114 Cells

IF any C-type RNA virus remains longer than a few months in the list of contenders for the dubious distinction of being the first human RNA tumour virus to be discovered it is time to start to take the claim seriously. So many people are intent on finding human RNA cancer viruses homologous to the sarcoma and leukaemia viruses in lower mammals and birds that every suspect virus is immediately and extensively screened by competing research groups. Usually the particular virus is quickly eliminated by being shown to be a contaminating animal virus, but one putative human cancer virus, the so-called RD 114 virus, has withstood such testing for the past several months. It really seems that RD 114 virus may have a human origin and information about the lineage of the RD 114 cells which liberate the virus, such as that reported by Nelson-Rees, McAllister and Gardner in next Wednesday's *Nature New Biology* (April 5), assumes considerable importance.

The viruses which liberate the RD 114 cells isolated by McAllister and his colleagues have an unusual history. They were obtained as direct outgrowths when a piece of a solitary rhabdomyosarcoma taken from the brain of a kitten was placed in culture. Some 78 days earlier the kitten, then a foetus, had been injected with a line of human rhabdomyosarcoma cells called RD 2 cells. These RD 2 cells do not produce a C-type virus but the RD 114 cells do. Initially everybody anticipated that the human cells had picked up a feline leukaemia virus during passage in the kitten. Repeated and diverse tests aimed at showing that the RD 114 virus is a cat virus have, however, failed and the possibility remains that the virus has a human origin.

So much for RD 114 virus but what about the RD 114 cells themselves? Can one be sure they are human cells and not cat cells? The analyses of the chromosomal constitutions of populations of RD 2 cells and RD 114 cells reported by Nelson-Rees *et al.* establish beyond doubt that the RD 114 cells are human cells. Moreover, the presence of a ring marker chromosome in about 70–80 per cent of RD 114 cells but only about 10 per cent of RD 2 cells can be interpreted as evidence that the brain tumour from which the RD 114 cells were isolated arose from the proliferation of just one or a few of the inoculated RD 2 cells. In other words the tumour from which RD 114 cells were isolated may have been a clone from one RD 2 cell.