Natural rates of sediment containment of PAH, PCB and metal inventories in Sydney Harbour, Nova Scotia

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Sydney Harbour in Nova Scotia, Canada has long been subject to discharges of contaminants, including metals and polycyclic aromatic hydrocarbons (PAHs), from a local coking and steel manufacturing facility. It is estimated to hold 700,000 tonnes of coal tar contaminated sediment, representing 3500 tonnes of PAHs as coal tar. Radionuclide tracers (^{210}Pb and ^{137}Cs) have been measured in forty one sediment cores to determine time scales for the historical accumulation of contaminants in Sydney Harbour and to predict future harbour remediation rates. Contaminants such as Pb, PAHs and PCBs, discharged prior to the closure of the steel facilities, are cycling through depositional regimes in the harbour on time scales of 10-15 years, but their concentrations in recently deposited sediments are gradually decreasing owing to the continuous deposition of less contaminated material. As a result, the contaminant inventory is being buried at a rate of 0.2-2 cm/y throughout the harbour. Using a "systems time averaging" model, the future contaminant field has been mapped for Sydney Harbour. It is predicted that surface sediment contaminant levels will fall below the *effects range-medium* (above which organisms are very likely to be negatively affected by the presence of a contaminant) by 2030. These results suggest that despite the present day, high contaminant levels in Sydney Harbour they represent a minimal long term, environmental threat and that barring their remobilization by dredging, natural containment will reduce contaminant levels below those predicted to have a significant impact on organisms during the next 10-20 years.

VLT-CRIRES observations of ^{12}C/^{13}C fractionation in protostellar envelopes

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The newly implemented Cryogenic Infrared Echelle Spectrograph (CRIRES) at the Very Large Telescope (VLT) in Chile was used to acquire very high resolution ($R = \lambda/\Delta\lambda \approx$ 95,000) ro-vibrational spectra of CO in nearby embedded young stellar objects (YSOs). In favorable circumstances, such data can yield quantitative determinations of the isotope ratios of both carbon and oxygen in YSOs [1]. Such data may have important implications for chemistry in the accretion disk. Our ultimate goal is to be able to compare these observations to meteorite and solar data to better understand the evolution of volatile elements in the solar nebula.

Here we present new ^{12}CO/^{13}CO measurements of objects still embedded in their parental molecular cloud; a portion of the fundamental CO band of IRS 63 is shown in Figure 1. Preliminary results suggest ^{12}C/^{13}C ratios ~150, significantly exceeding the solar system ratio of ~89 [2, 3] and varied estimates of ^{12}C/^{13}C ratios in the local ISM made by radio and infared observations [eg, 1, 4 and references therein].

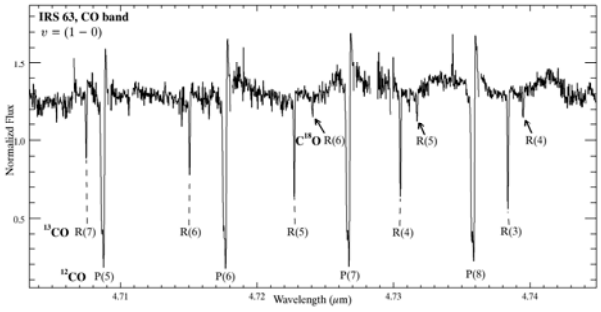

Figure 1. Fundamental ro-vibrational CO band for IRS 63, taken with CRIRES. Several CO lines are marked.

[1] Smith *et al.* (2009) *ApJ*, in prep. [2] Anders & Grevesse (1989) *GCA* **53**, 197-214. [3] Grevesse *et al.* (1996) *Cosmic Abundances*, San Francisco: ASP, **117**. [4] Goto *et al.* (2003) *ApJ* **598**, 1038-1047.