directly from olivine would require a reaction of this kind:

$$3(Mg,Fe)_2SiO_4 = Mg_3Fe_2Si_3O_{12} + Fe$$

that is, a simultaneous oxidation of two atoms of iron to the ferric state and reduction of one atom to the metal. Moreover, the proportions of Mg to Fe in the olivine are 3 : 1, not 1 : 1 as required in the above equation. A balanced equation for these proportions would be more complex, for example

$$6(Mg_{.75}Fe_{.25})_2SiO_4 = Mg_3Fe_2Si_3O_{12} + Fe + 3Mg_2SiO_4$$

thus involving the concomitant formation of magnesium-rich olivine. Probably the garnet is so finely dispersed throughout the olivine that it is beyond the resolving power of the microprobe beam, and the above analyses do not give its true composition. Otherwise we must consider the possibility of a nonstoichiometric composition, maybe a "stuffed" garnet with a total of six 6- and 8-coordinated cations for 12 oxygen ions instead of five as in the normal garnet structure.

Did the garnet form in the meteorite extraterrestrially or after its arrival on Earth? We believe the following evidence supports an extraterrestrial origin. Significantly, the garnet is confined to a veinlet that resembles shock-produced veinlets in other meteorites. Impact on Earth of a small meteorite like Coorara would not produce such shock effects. Terrestrial weathering is unlikely to convert olivine to garnet; terrestrial alteration of olivine in igneous rocks is of common occurrence, but it has never been reported to result in the formation of garnet. Garnet is usually the product of metamorphic recrystallization of rocks under considerable pressures and is a notably dense phase—compare Mg_2SiO_4 (olivine), sp. gr. 3.21; Mg_2SiO_4 (spinel), sp. gr. 3.53; and $Mg_3Al_2Si_3O_{12}$ (garnet), sp. gr. 3.56.

When we first observed this isotropic mineral in the Coorara meteorite, our immediate reaction was that we had found the spinel form of $(Mg,Fe)_2SiO_4$. The existence of this form has been predicted on crystallochemical grounds for some years; it has recently been made in the laboratory by Ringwood and Major (*2*). The conversion of olivine with the composition $(Mg_{.75}Fe_{.25})_2SiO_4$ to the spinel form takes place at about 170 kb at 900°C. This transformation is believed to occur in the Earth's mantle at depths of about 500 km. The possibility of olivine transforming into garnet has never been suggested, but this transformation would have geophysical results similar to those predicted for an olivine-spinel inversion in the upper mantle.

It seems remarkable that this conversion of olivine into garnet in a stony meteorite has not been observed previously. Coorara is not an unusual meteorite; hundreds of essentially similar ones are present in the collections of this and other institutions. Many of these have been sectioned, and had any of these sections contained this striking purple mineral it would certainly have been noticed. Evidently some rare, possibly unique, circumstances were involved in its formation. What these circumstances were, apart from the probability of high pressure and temperature induced by extreme shock, we have yet to discover.

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Carbon Monoxide and Air Pollution from Automobile Emissions in New York City

Abstract. *Local business-day traffic determines the diurnal carbon monoxide concentrations at individual sites in Manhattan. Concentrations during the day can be predicted from readings taken in early morning.*

The Department of Air Pollution Control of the City of New York has embarked upon an intensive program to control carbon monoxide. The program is based upon the measurement of carbon monoxide emissions and the behavior of the gas in the atmosphere at different locations under different conditions. The Department estimated the daily emissions of pollutants from automobiles for each square mile in the city. Estimated totals of these emissions for the entire city were:

Carbon monoxide	4140 ton/day
Hydrocarbons	560 ton/day
Oxides of nitrogen	106 ton/day

The estimates indicated that midtown and lower Manhattan were main sources of automobile exhaust gases. Steps were taken to determine how local traffic conditions influence the atmospheric concentrations of automobile exhaust gases measured at a given location.

Equipment to monitor continually carbon monoxide concentrations was installed near street level at five locations in Manhattan. The largest amount of valid data was obtained at 110 East 45 Street from 6 January through 17 May 1967, and from 30 July through 14 September. The sampling probe was set approximately 15 feet above the pavement and 5 feet into the street from the curb. A continuous flow of air was analyzed and recorded 24 hours per day, 7 days per week. The average hourly concentrations exceeded 15 parts per million from 9:00 a.m. to 7:00 p.m. New York State recommended that carbon monoxide concentrations of 15 parts per million for 8 consecutive hours should not be exceeded more than 15 percent of the time.

The apparent correlation between the business day and measured atmospheric carbon monoxide concentrations spurred further investigation, the results of which are shown in Fig. 1. They show simultaneous hourly traffic counts and hourly average concentrations of carbon monoxide for 4 April 1967. The traffic volumes for each hour are the totals for all traffic moving on Park Avenue past 45th Street itself. The shapes of the curves for traffic count and carbon monoxide are markedly similar, indicating that local concentrations of atmospheric carbon monoxide are strongly influenced by local traffic conditions.

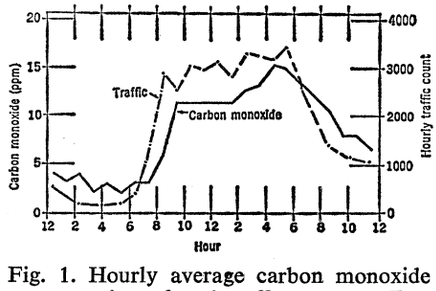

Fig. 1. Hourly average carbon monoxide concentration of and traffic count at East 45 Street; *ppm*, parts per million.

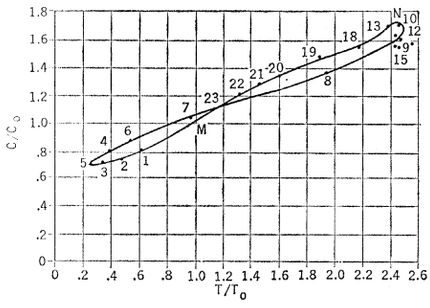

Fig. 2. Normalized concentration—traffic curve at East 45 Street.

The data obtained from the carbon monoxide samplers operated during portions of 1967 indicate that: (i) Business-day traffic determines the basic shape of the curve for diurnal carbon monoxide concentration in Manhattan. (ii) Local traffic conditions are the primary influence upon concentrations of carbon monoxide measured close to street level. The problem of automobile exhaust for a large city of metropolitan area may be the sum of local problems related to local traffic conditions.

An effort is being made to predict the hourly average concentrations of carbon monoxide for each day. When the average concentration of carbon monoxide is plotted against the time of day, the resulting curves are similar in shape from station to station, although their amplitudes and time phases differ. Therefore, we attempted to predict hourly concentrations of carbon monoxide from readings taken in the very early morning. Accordingly, the curves were smoothed through the use of a 2-hour moving average. Each of the smoothed hourly values was then divided by the midnight average, C_0. To predict the hourly concentrations of carbon monoxide, we first determined C_0 by direct measurement. We then forecast the concentration at each hour of the following day by multiplying C_0 by the ratio indicated on the average curve for that station. When this method was used to predict daily peaks, the predicted values fell within 5 parts per million of the measured values about 70 percent of the time for stations at Park Avenue South, Times Square, Herald Square, and East 45 Street.

The limitations of this predictive method are dictated by the dispersion in the hourly averaged data. The mean daily standard deviation is between 4 and 5 parts per million. This is consistent with the error in the predictions. There is a cause-and-effect relationship between traffic and carbon monoxide concentration. Hourly averages of traffic volume for the five sites were obtained from the Traffic Department. These data were smoothed and normalized in exactly the same fashion as the carbon monoxide data were. In order to eliminate time between the two sets of data, the relative carbon monoxide concentration, C/C_0, was plotted against T/T_0. In Fig. 2, a curve has been drawn through the points in the chronological order in which they appear.

Carbon monoxide concentration and traffic volume are periodic functions of time, and each can be represented by a Fourier series. When time is eliminated between the two functions and they are plotted as orthogonal coordinates (Fig. 2), closed curves somewhat akin to Lissajous figures should result.

The carbon monoxide concentration and the traffic volume are not in phase, and accordingly the increases and decreases in the curves do not coincide. The carbon monoxide concentration lags the traffic volume during the increase and much of the decrease in the curve. Carbon monoxide concentration does not build up as rapidly as the traffic perhaps because the traffic exhausts into a relatively clean atmosphere in which dilution is relatively good. A relatively dirty atmosphere prevents the carbon monoxide concentration of the traffic from decreasing as rapidly as the traffic does. This phase shift is consistent with a diffusion process.

For all sites the carbon monoxide concentration and the traffic volume are nearly in phase from midnight until some hour between 3 and 5 a.m. Thus, the decay rate of the carbon monoxide increases after the concentration and traffic volumes fall below a certain value characteristic of each station. This phenomenon may explain the crossing of traffic volume and carbon monoxide curves as each begins to increase and again when they fall off.

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Salt Transport in Valonia: Inhibition of Potassium Uptake by Small Hydrostatic Pressures

Abstract. *Internally perfused cells of the marine alga* Valonia *actively transport potassium from external seawater into the cell vacuole. This active uptake of potassium is reduced by restoring the normal turgor pressure of 1 atmosphere by means of a mercury manometer attached to the internal perfusion system. This inhibition of salt uptake by a small hydrostatic pressure suggests that* Valonia *and other walled cells may regulate their turgor pressures by adjusting their rates of salt uptake.*

Cells of most plants and microorganisms are protected from osmotic swelling by a rigid cell wall which surrounds the protoplast (*1*). The presence of this cell wall permits the development of a turgor pressure which is approximately equal to the difference between the osmotic pressures of the intracellular and extracellular fluids. Turgor pressures vary widely among walled cells, ranging from about 1 atm in the giant-celled algae *Valonia* and *Halicystis* to about 20 atm in certain microorganisms (*2, 3*).

In some algae the turgor pressure is nearly constant over a wide range of environmental salinities (*3, 4*). In *Chaetomorpha linum,* for example, the turgor pressure is 13 to 14 atm, although the osmotic pressure of the environment ranges from about 0 to 23 atm (freshwater to seawater) (*4*). This leads one to ask whether walled cells regulate their turgor pressures and, if so, by what mechanism.

A possible answer to this question is suggested by the early work of Blinks and Jacques (*5, 6*), who impaled cells of *Valonia* and *Halicystis* on glass capillaries and then observed the rate at which fluid (sap) moved up the capillary. Jacques (*6*) observed that the rate of fluid uptake was 10 to 15 times higher in impaled than in control cells which grew at a rate of 0.8 to 1.0 percent per day. The only large variable in Jacques's experiments was the turgor pressure, which was 0.5 to 2 atm in normal cells but virtually zero in impaled cells. In other experiments, Jacques abolished the turgor pressure by immersing *Valonia* cells in hypertonic seawater, and again the cells responded by rapidly absorbing salts and water until the normal turgor pressure was restored.

Jacques's results are surprising be-