The Rb-Sr age was originally reported at 780 million years, but if calculated with the constant used in this paper (Table 1) the revised age is 730 million years.

Eckelman and Kulp (*9*) arrived at a U-Pb age of 1190 million years for pitchblende from the Sunshine Mine from the Coeur d'Alene district of Idaho, giving a minimum age of approximately 1200 million years for the Belt Series rocks. The K-Ar age of 1200 million years for phyllites in the Coeur d'Alene district reported by Goldich (*10*) is erroneous and should be ignored. Hunt (*11*) reports some K-Ar ages that were completed recently by H. Baadsgaard for micas and amphiboles from the Purcell sills in Belt rocks in British Columbia, Canada, and in Montana. The mica ages are all considerably less than 1000 million years, the oldest being 844 million years; however, two samples of amphibole and a whole-rock sample of hornfels fall within a narrow range of 1070 to 1110 million years. In addition, two amphiboles give surprisingly high ages of 1400 and 1580 million years. If the latter ages are satisfactory, the glauconite age for the Missoula Group may be considerably low.

A more detailed mineralogic and geochronologic study of glauconite and related minerals of the Belt Series of Montana is now in progress (*12*).

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Venus: A Map of Its Brightness Temperature

Abstract. *The 200-inch Hale telescope has been used to make high-resolution maps of the brightness temperature of Venus at wavelengths 8 to 14 microns. Resolution of about 1/30 of the disk reveals a general symmetry about the plane of the orbit, no day-night temperature effects, and a transient temperature anomaly in the southern hemisphere.*

Interest in the planet Venus has been heightened by the successful return of data from man's first planetary probe, Mariner II. Exciting new observations of Venus have also been made recently with large ground-based optical and radio telescopes and radar systems. We now report on high-resolution observations, made with the 200-inch Hale telescope at Palomar Mountain on the mornings of 13, 14, 15, and 16 December 1962, of infrared radiation emitted from Venus.

Infrared radiation is transmitted through the earth's atmosphere in a "window" of wavelengths 8 to 14 microns. We used a special photometer incorporating a mercury-doped germanium photoconductive detector cooled with liquid hydrogen (*1*) to measure the intensity of the 8 to 14 micron radiation emitted from Venus as collected and imaged by the telescope. The photometer was mounted at the *f*/16 focus in the east arm of the yoke. The focal plane aperture we used restricted the circular field of view through the telescope to a diameter of 1.5 seconds of arc, or about 1/30 the planetary diameter. The image of Venus was scanned by moving the telescope in right ascension at successive declination settings and thus building up a series of parallel profiles of output voltage deflections. By using the instrumental calibration curve and allowing for assumed atmospheric transmission losses, we converted the deflections into brightness temperatures. Such brightness temperatures are not unambiguously relatable to the actual kinetic temperature distribution because the sources of opacity and the energy transport mechanisms (time-dependent case) are not well known.

The strong limb-darkening obvious in Fig. 1 and also in the maps made on the other three nights is evidence that the emergent radiation comes from a range in depth over which the temperature increases significantly. This effect alone would produce a radially symmetric pattern rather than the bilaterally symmetric pattern shown. The data thus suggest that there is a real geographic variation of atmospheric boundary temperature. The simplest, but not the only, interpretation of this departure from radial symmetry is as follows. First, there is little or no difference in atmospheric temperature between the daytime and night-time portions of the disk, a result indicated by the previous work of Sinton (*2*) and Pettit and Nicholson (*3*). Gross differences would be expected if there were a significant diurnal temperature variation in the planetary atmosphere. Second, there is an apparent "insolation" effect. The portion of the planetary disk which is intersected by the orbital plane of Venus—that is, the "equatorial" zone if the planet were imagined to be rotating about a spin

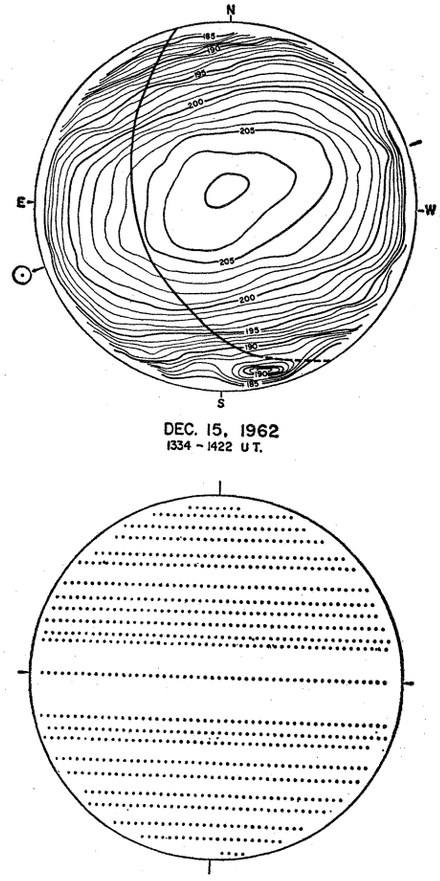

Fig. 1. Brightness-temperature contour map of Venus at wavelengths 8 to 14 microns. The bottom chart shows geographic location of points where the continuous scan records were sampled and reduced. The slightly crenulated pattern running in an east-west direction results from slight uncertainties in positioning the scans.

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axis approximately normal to the orbital plane—appears to be about 10°K hotter than the "polar" regions. We have used quotation marks around the terms *insolation, equatorial,* and *polar* because such a mode of rotation *may* be inconsistent with the recent interpretation of radar observations (*4*). Fortunately, both kinds of observations can be repeated at various phases of Venus, perhaps with more sensitive and accurate equipment in a year or so, and other types of ground-based observations may also prove to be of significance to the question of rotation.

The other feature of interest in Fig. 1 is the anomalously warm area in the southern hemisphere of Venus, near the terminator. Observations of this region on the other three mornings, although not as detailed as those shown in Fig. 1, definitely show that the structure changes radically in temperature distribution and geographic extent over a 24-hour time interval, whereas the remainder of the disk remains unchanged. The feature may justly be described, therefore, as a storm in the atmosphere of Venus. Continued observation of such features in the future should provide a powerful means of investigating the dynamics of the atmosphere of Venus (*5*).

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Local Anesthetic Drugs: Penetration from the Spinal Extradural Space into the Neuraxis

Abstract. *Local anesthetics, injected into the spinal extradural space, can be recovered from the spinal cord and brain. Transport from the extradural space into the neuraxis is independent of an active circulation. Distribution is greatest in the periphery of the cord and is most intense near the site of injection. The drugs probably diffuse into the subperineural spaces of the mixed nerves and then pass centripetally along the spinal roots into the cerebrospinal fluid and the cord.*

Conduction anesthesia by the injection of local anesthetic drugs into the extradural (epidural) space of the spinal canal is a well-established technique in human and veterinary surgical practice, but the principal site of neural blockade is still in doubt. The possible sites of action which have been suggested are the mixed nerves in the paravertebral spaces, after passage through the intervertebral foramina (*1*), the dorsal root ganglia (*2*), or the spinal cord itself (*3*). There is some evidence both for and against each of the three possibilities, but spinal cord or neuraxial spread has not been directly investigated, although indirect clinical data suggests that it does occur (*4*).

A pilot study was carried out with colorimetric and radiometric techniques in adult dogs to determine if local anesthetic drugs do pass from the extradural space to the spinal cord and brain. Under light pentobarbital anesthesia the sacrum was exposed and a polyethylene catheter advanced through a sacral burr hole into the extradural space, until the tip was opposite the first lumbar vertebra. Extradural blockade was produced by 2 percent lidocaine (in eight dogs) or mepivicaine (in one dog), labeled with C^{14} (2 μc/ml). Adrenaline hydrochloride (1/200,000) was added to the solutions to reduce vascular absorption. These solutions were injected through the catheter by increments of 3 to 5 ml at intervals of 30 minutes, up to a total dose of 7.5 to 15 ml containing 150 to 300 mg of active drug. The animals were killed by exsanguination 45 minutes after the last injection, and the cerebrospinal fluid was drained by cisternal puncture. The epidural space and catheter were flushed with 100 ml of normal saline to remove any residual analgesic solution, and the brain was removed. The spinal cord with meninges and extradural roots was then carefully dissected out in one piece and divided between tight ligatures into four equal lengths. Each of these was dissected to provide samples of extradural roots, intradural roots, dura mater, piarachnoid, and cross sections of stripped cord.

Samples were analyzed for radioactivity by a counting method, and for unchanged lidocaine by Sung and Truant's modification of the methyl-orange technique of Way *et al.* (*5*). The former method does not distinguish between the unchanged labeled drugs and their metabolites, whereas the latter can be made highly specific for unchanged lidocaine by using an appropriate phosphate buffer at a *p*H of 6.22. Agreement between the two methods would indicate that the radioassay was measuring unchanged drug. Since the colorimetric method requires relatively large amounts of tissue for accurate results, it was not suitable for the small quantities of dura, pia, and spinal roots which were available. However, from specimens of cerebellum, medulla, cord, cerebrospinal fluid, and blood, satisfactory assay was made by both methods.

Duplicate samples of solid specimens were prepared for counting by the following procedure. Samples of 50 mg of wet tissue were digested for 48 hours in Hyamine hydroxide [*p*-(diisobutyl-cresoxyethoxyethyl)-dimethylbenzylammonium hydroxide], and then heated in a water bath at 70°C for 2 hours or until clear. Then 0.5 ml of 100 percent ethanol was added to each sample together with 19 ml of phosphor [0.3 percent of 2,5-diphenyloxazole and 0.01 percent of 1,4-bis-2(5-phenyloxazolyl)-benzene in toluene]. Samples of blood and cerebrospinal fluid were treated with 15 percent trichloracetic acid followed by 10*N* sodium hydroxide and extracted in ethylene dichloride for counting. Samples were assayed for C^{14} content with a Packard Tri-Carb liquid-scintillation spectrometer (model 314-X). An internal standard of C^{14} was used to correct for quenching and efficiency of counting (*6*).

In two dogs the procedure was modified for autoradiographic examination of the neuraxis. The spinal column was excised in 1-inch lengths, and the enclosed segments of cord were extruded and dropped into liquid nitrogen or a mixture of carbon dioxide and acetone. Sections were cut 25 to 30 μ thick on a cryostat at −20°C. The sections were transferred directly to microscope slides, covered with Mylar film (DuPont) 10 μ thick, and placed in contact with Ilford Ilfex "No-screen" x-ray film under gentle pressure from foam-rubber pads. The films were exposed