is in need of information regarding the location of museum material in order that such material may be more fully utilized. To meet these needs a proposal has been made that some central agency attempt the compilation of what might be called an analytical directory of museums.

Data regarding museums, which would permit of the fullest utilization of the vast stores of material and at the same time assist those engaged in museum work to study the relations of individual institutions to museums as a whole, would need to be national in scope. A mass of material concerning every museum should be brought together and arranged in such a manner that the field could be viewed from a great variety of angles in an expeditious manner. No single museum would be justified in undertaking a work of this sort, yet every institution would doubtless be willing to cooperate. Its publication by a central agency, such as the American Association of Museums, would be feasible, and the demand for such a book promises to be sufficient to warrant the undertaking.

The increase in the number as well as the size of American museums has made a knowledge of their collections far beyond the capacity of even a large group of persons. While a specialist in a single field may be informed regarding the location of all important material appertaining to his branch of science or art, it is often difficult to get into immediate communication with such a person, and many would be required in order to cover the entire field of modern museum effort. The value of summarizing the information possessed by those best qualified to interpret museums becomes apparent when we consider the advantages of using the material not of one museum but perhaps of a dozen or more.

Very few museums have series of objects in any category which are not supplemented and amplified by the possessions of other institutions. The immediate knowledge of the whereabouts of all important accumulations covering a certain subject may be of inestimable value to an investigator. A published survey of the sort suggested would obviate in many cases the necessity for hurried and often cursory inquiries among a few museums selected more or less at random. Advantages would accrue not only to the public but museums would find themselves benefitting from the increased interest in and use of their collections.

When museums as a group have available exact information as to their status with relation to the political divisions of the country, to population and to each other, more efficient administrative methods will be possible and certain duplications of effort will be revealed. Perhaps no greater need for information regarding the distribution, kinds of museums and means of support, is felt than by the organizers of proposed institutions or the directors of small existing museums. With many duties of a highly diversified character often imposed upon a single person in the capacity of director, the need for tabloid information is keenly felt.

These statements recognize briefly the two main divisions of the proposed analytical directory. Elaboration of what might be called the professional aspect would include statistical consideration of museums in relation to population, distribution of the different types of museums, relative attendance, types of administrative control, tables showing increase in the number of museums and sundry other arrangements of facts. In order to supply the kinds of information usually sought by the general public the directory would list museums geographically as well as according to type, there being general descriptions of each organization and its scope. Indexes would furnish a key to the location of all important collections in a large number of fields, descriptions furnishing some indication of the relative importance and extent of each accumulation. Other lists would show the serial publications of museums, staff members, educational and other activities carried on to supplement exhibited material. Further ramifications would suggest themselves as the work progressed and could be incorporated if time and funds permitted.

RALPH CLIFTON SMITH,
Acting Director, The American Association of Museums

OCCURRENCE OF GERMANIUM IN TOPAZ

IT is an established fact that germanium is closely related to tin in a chemical sense. The two elements have analogous compounds and they occur together in natural minerals such as sphalerite and enargite. With this as a basis a search for germanium was undertaken in cassiterite from numerous localities. The arc spectrographic method was employed[1] and it was observed that while germanium was present in practically all the cassiterites examined, it was present in them in bare traces. This low content could be explained by assuming that the original magma carried very little germanium as compared with tin. But since nothing is known of the mineralogical identity of germanium in cassiterite, it was safe to assume that, irrespective of chemical similarity, segregation took place during or before the final formation of the hypothermal veins or pegmatite dike minerals. Lack of isomorphism, complexity of ions,

[1] For a description of this method see Papish, Brewer and Holt, *Jour. Amer. Chem. Soc.*, 49, 3028 (1927).

differences in solubility and volatility, may have caused the germanium to attach itself to other members of a given deposit. With this possibility in mind the search for germanium is being extended to a number of pegmatite and high temperature vein minerals, as well as to gangue materials. The spectrographic work on topaz, which is completed, proves conclusively that topaz in the massive as well as in the crystalline form contains germanium. Thirty-four specimens of topaz from twenty-seven different localities were examined and all were found to be germaniferous. Some topazes from Schneckenstein, Saxony and from Zinwald, Bohemia, were among those which contained minute traces of the rare element. Their spectrograms included only two of the most persistent germanium lines within the spectral range examined. The majority of topazes contained much more germanium, a fact substantiated by the larger number of spectral lines of this element. Notably among these were specimens from the following localities: Trumbull, Connecticut; Stoneham, Maine; Florissant, Colorado; Naegi Mino, Japan, and Silver Leaf Mine, Manitoba. Work is now in progress on the quantitative determination of germanium in topaz.

JACOB PAPISH

CORNELL UNIVERSITY,
DEPARTMENT OF CHEMISTRY

HETEROTHALLISM IN THE RUSTS

THE cytological advances in the study of the rusts which revealed a pairing of nuclei with ultimate fusion, regarded as possible sexuality, definitely led to interest in the origin of the associated nuclei. The question whether the nuclei coming together in the fusion cell originated in separate cells of the same mycelium, or whether two separate mycelia might be involved, was a natural one. The possibility of the latter, heterothallism, has no doubt occurred to many workers and definite suggestions are not wanting (Dodge[1]; Arthur and Kern[2]). Cytological methods have not yielded any evidence. The most suggestive results have been brought forward by Craigie,[3] based on cultural studies.

Working with *Puccinia Helianthi,* Craigie[3] directed his attention toward producing infection from single basidiospores. Such infections lead to what he calls monosporidial pustules. He reports that in approximately 50 per cent. of the cases where monosporidial pustules are near enough together to coalesce aecia are promptly produced. Isolated monosporidial pustules develop pycnia, but usually do not develop aecia within two or three weeks, and then only in a minority of the infections. His results led him to the conclusion that the basidiospores are unisexual, producing unisexual mycelia, which interact when in contact, giving fusion cells in the spore-bed of the aecia. Later, working with *Puccinia graminis* cultures on the barberry as well as with *Puccinia Helianthi,* Craigie[4] reports that, in addition to contact and spontaneous development, there is a third manner in which monosporidial pustules may change from the haploid to diploid condition. This consists in the transfer of pycniospores from one monosporidial pustule to the pycnia of another monosporidial pustule. Flies are said to carry the pycniospores in the nectar. The facts seem to be clear that mixing the pycniospore-containing nectar does lead to early and abundant development of aecia. That this is due to germination of pycniospores, mycelial production and fusion to bring on the diploid condition has not been made clear. Craigie postulates that some of the monosporidial pustules have a + mycelium, others a − mycelium, each of course being haploid. He believes that when + and − mycelia come in contact the diploid condition is effected which results in prompt formation of the binucleate aecial structure.

There seems to be no doubt that the contact of two mycelia of monosporidial origin or the mixing of pycniospores has a positive and stimulating effect on the production of aecia, but no conclusive evidence of what happens has been brought forward. It is a well-known fact that when two cultures of ascomycetes are grown together on opposite sides of a petri dish more ascocarps may be produced along the line of contact than when either culture is grown alone. Many other instances have been cited showing that bacterial or fungous contaminations, as well as different colonies of the same fungus, may have a beneficial effect in stimulating the production of ascocarps. It is evident that the stimulation of the sexual reproductive process when two mycelia are growing in proximity is not necessarily a proof of heterothallism, although it may be admitted as an indication. The subject awaits further experimental investigation, accompanied by painstaking cytological observations, and may yield facts not only of biological interest but of practical importance.

FRANK D. KERN

THE PENNSYLVANIA STATE COLLEGE

[1] B. O. Dodge, "Uninucleated Aecidiospores in *Caeoma nitens,* and Associated Phenomena," *Jour. Agr. Res.,* 28: 1045–1058, 1924.

[2] J. C. Arthur and F. D. Kern, "Conversations with European Mycologists," SCIENCE, 63: 558–560, 1926.

[3] J. H. Craigie, "Experiments on Sex in Rust Fungi," *Nature,* 120: 116–117, 1927.

[4] J. H. Craigie, "Discovery of the Function of the Pycnia of the Rust Fungi," *Nature,* 120: 765–767, 1927.