is therefore less ground for change of generally accepted opinions than the suggestion of the need of revision might for the moment indicate.

The second consideration concerns the processes of combined induction and deduction by which the complete or logical method of scientific investigation is constituted. In view of the possible change of interpretation now open for truncated uplands according to Passarge's law, it might be said by one who prefers to work on more purely inductive lines: "Behold, here is another case in which deduction has led the investigator astray! He thought that he could deduce the sole conditions under which truncated uplands could be formed, and that these conditions necessitated uplift after degradation; now he finds a new series of conditions under which such uplands may be formed and all his previous conclusions are uncertain. Let us, therefore, beware of deductive or imaginative methods, and hold fast to the safer methods of observation and induction." In reply to such a warning, one might say—besides pointing out that all problems which deal with unseen processes necessarily involve deduction and that the deductive side of the work should be conscious and systematic —that the fault in the method by which truncated uplands have heretofore been discussed lies not in the too free use of deductive methods, but in their too limited use. The mistake lies in our not having years ago set forth, by purely deductive methods, just such an analysis of the geographical cycle in an arid climate as has now been provoked by the discovery of rock-floored desert plains. Such an analysis does not involve any new or difficult problems; it might have been successfully attempted long ago; the difficulty that stood in the way lay not in the problem itself, but rather in the habit among physical geographers of trusting too largely to observational methods and of neglecting the aid that deductive methods furnish. The lesson of the problem is, therefore, that deduction should be pushed forward more energetically and systematically than ever; always checking its results as far as possible by confronting them with the appropriate facts of observation, but never halting in the reasonable extension of deductive conclusions because the corresponding facts of observation have not been detected; never lessening the activity with which exploration and observation are pursued, but always using the spur of deduction along the paths suggested by 'multiple working hypotheses.' The problem of the erosion of mountain valleys of Alpine glaciers teaches the same lesson: if physiographers had, thirty years ago, been well practised in deductive methods, they might have easily extended Playfair's law regarding the accordant junction of branch and trunk streams from the case of stream surfaces to the contrasted case of stream beds, and from the case of water streams to the analogous case of ice streams; thus they might have predicted that, if Alpine glaciers were effective eroding agents, glaciated mountain valleys ought to show discordant or hanging side valleys; and in going to the mountains they would have found the prediction correct, and the basis of the prediction—that glaciers are effective eroding agents—would have thus been verified. So with the geographical cycle in an arid climate: there is nothing difficult in the series of deductions that lead to the expectation of rock-floored desert plains, independent of baselevel, as the product of arid erosion; the only obstacle to the development of these deductions has been the habit of not making them. This is a habit that should be broken.

W. M. Davis.

NOMENCLATORIAL TYPE SPECIMENS OF PLANT SPECIES.

The recent 'Code of Botanical Nomenclature' now usually known as the Philadelphia Code, states as the fourth fundamental principle, 'The application of a name is determined by reference to its nomenclatorial type.' This means that a specific (or subspecific) name stands or falls according to the disposition of the type specimen. It is not proposed here to discuss the advantages or disadvantages of this method of determining the application of names, although to the writer this method seems much more likely to secure 'stability, uniformity and convenience in the

designation of plants,' than the method of applying the name according to tradition, authority or consensus of opinion. Instead of this, then, it is proposed to discuss briefly the practical difficulties which may arise in this method of types, and how these difficulties may be overcome.

The code mentioned above states in regard to the application of names (Canon 14) the following: 'The nomenclatorial type of a species or subspecies is the specimen to which the describer originally applied the name in publication.'

Where an author in connection with an original description has indicated a definite specimen, there is usually no difficulty in determining the type. When an author indicates only the number or other data occurring on the label in numbered sets prepared for distribution, but does not specify a particular specimen, the type would be the one from which the author drew up the description and would presumably be in his herbarium. The other specimens would then be designated as duplicate types. Not infrequently the author draws the description from all the specimens of a given number in a set, in which case the specimen in the herbarium of the author, or of the institution at which he is located, must be arbitrarily chosen as the type.

Many difficulties arise in determining the types of the older authors, as the practise of designating specimens as such is quite recent. When a name is based upon a single specimen this becomes the type though not actually designated as such. If more than one specimen is cited, but none designated as the type it becomes necessary to select one of these.

The above mentioned code provides that 'When more than one specimen was originally cited, the type or group of specimens in which the type is included may be indicated by the derivation of the name from that of the collector, locality or host.' (Canon 14, a.) Further, if no type can be selected on this basis, 'Among specimens equally eligible, the type is that first figured with the original description, or in default of a figure, the first mentioned.' (Canon 14, b.)

There are many original descriptions, however, in which no specimens are cited, but instead the locality or range may be given. It then becomes necessary to consult the author's herbarium or the herbarium in which his plants are deposited. Specimens which bear the name in his handwriting should be given preference in the selection, and of these the type is the one from the locality first mentioned, or the one collected by the person for whom the species is named. Even with these aids in selection it may be necessary to arbitrarily select a certain specimen from among those equally eligible. This should be done by a monographer and only after a careful examination of the available data. Where possible the most perfect specimen should be selected or the one most nearly corresponding to the original description. For example, if the species is known to produce rhizomes and only one of the otherwise available specimens showed these organs, this specimen might be selected. Occasionally the original description includes more than one form and the specimens are correspondingly diverse. It is then very necessary to use particular care in the selection of the type. Muhlenberg described *Panicum depauperatum* without indicating a type. In his herbarium deposited in the Philadelphia Academy of Natural Sciences is the sheet of specimens upon which the name is founded. In this sheet are plants of *P. linearifolium* Scribn. and two forms of what is now considered to be *P. depauperatum* Muhl., one with glabrous sheaths and one with pilose sheaths. From the description one can not determine which one of these forms was intended. Probably all were included as one species. Since the form with smaller spikelets has been distinguished by Professor Scribner as *P. linearifolium* the type of *P. depauperatum* should be selected from the specimens with large spikelets. When the two or more species confused by one author are distinguished by a later author, this author should determine the type. The old specific name should remain with the type and the new name be based upon a different type. Much confusion has arisen because of failure to follow this rule. If the original specimens are made up of both species, the author of the

later name, the so-called segregator, should indicate which specimen is the type of each species. Professor Scribner might with equal propriety have given the new name, in the case above mentioned, to the form with large spikelets, except for the fact that tradition, and the recorded history of the plant had attached the name *P. depauperatum* to this form. But, as stated, the original specimens are in part with glabrous sheaths and in part with pilose sheaths. The original description states that the sheaths are pilose. In a recent study of this collection in preparation of a monograph of the *Panicums* I took the liberty of selecting a specimen from the cover that had pilose sheaths, and attaching a ticket with such indication.

Let us consider another case and suppose that a reference to Muhlenberg's herbarium had shown only a specimen of *P. linearifolium* Scribn. In this case this specimen would become the type of the species *P. depauperatum* Muhl., since it agrees with Muhlenberg's description, and the species which had been called *P. depauperatum* would receive a new name.

While it is true that the name of a species rests upon its type specimen, yet the specimen can not take precedence over the description. If it is clear that a supposed type specimen disagrees with the description to such an extent that it can not be the plant which the author describes, then the plant must be disregarded in determining the type. In a previous paper I mentioned that the specimen in the Linnean Herbarium labeled in Linnæus's handwriting *Agrostis rubra* is a panicle of a *Sporobolus,* apparently *Sporobolus juncea* of our southern states. There is clearly an error here as the plant does not agree with the description. On the other hand, there are many cases in which the type specimen does not agree in all respects with the description. The sheaths may be described as glabrous when a few of the lower may be pubescent. If there is no reasonable doubt that the specimen was examined by the author and is the specimen or at least one of the specimens upon which the description was based, such specimen should be accepted as the type.

In cases where the first cited specimen is chosen as the type according to rule, it not infrequently happens that this is a form which does not represent faithfully the author's idea of the species. The specimens may have been arranged geographically and the first locality may be represented by a specimen of an aberrant or uncertain form. But the rule is explicit on this point and is certainly easy to interpret and follow.

Torrey and Gray publish many of Nuttall's manuscript names, but in listing specimens those collected by Nuttall may not be mentioned first; nevertheless, his specimens should be taken as the type by a broad interpretation of Canon 14, a. *Cardamine hirsuta* L. *β acuminata* Nutt. mss. in Torr. and Gray Fl. 1: 85. The specimens cited are: British America, Richardson; Oregon, Nuttall. The latter specimen should be taken as the type.

When there is no original specimen we must make use of Canon 14, c, in determining what shall serve as the type: 'In default of an original specimen, that represented by the identifiable figure or (in default of a figure) description first cited or subsequently published, shall serve as the type.' It sometimes happens that the citations will lead to a specimen, which then should be taken as the type. *Poa flava* L. is based upon a citation from Gronovius Flora Virginica, that is, Linnæus gives a specific name to a plant described by Gronovius. A reference to Gronovius shows that he mentions a particular specimen, Clayton No. 273, which plant is deposited in the herbarium of the British Museum and is the type of *Poa flava* L.

I will now refer briefly to a second series of cases, those where there has been only a change of name. If a species has been transferred from one genus to another the type specimen is determined according to the rules mentioned above, by a reference to the original description. If a new name is given to a species because the old one is untenable, the type of the old name becomes the type of the new. There are no new difficulties presented here, if there is no doubt that there has been only a change of name. However, one finds many cases where an author has

changed a name and at the same time has given a description of the species as he understands it. The description may not agree with the historic type. If the author states the synonymy in such a manner that there is no doubt that he meant to change the name of a given species, the old type must be retained regardless of the description or the specimens cited at the time the change is made. This may sometimes become a question of judgment to decide whether there is primarily a change of name or a description of a species with a doubtful reference to a previously published species. For example:

(*a*) *Panicum barbipulvinatum* Nash. Mem. N. Y. Bot. Gard. 1: 21. 1900.

Panicum capillare brevifolium Vasey; Scribner, Bull. U. S. Dept. Agric. Div. Agrost. 5: 21; not *Panicum brevifolium* L.

Then follows an extended description and finally a specimen is cited as the type (Rydberg and Bessey 3544). This is evidently a change of name and the type should remain the same and be determined by a reference to the original publication of *P. capillare brevifolium* Vasey, where a certain specimen from Montana is mentioned, Rydberg & Shear 436. Even though it may have been that the plant described by Mr. Nash was a different species, still the name *P. barbipulvinatum* Nash is a typonym of *P. capillare brevifolium* Vasey and a new type can not be assigned.

(*b*) *Panicum scribnerianum* Nash. nom. n. Bul. Torr. Bot. Club. 22: 421. 1895.

Panicum scoparium S. Wats. in A. Gray, Man. Ed. 6, 632. 1890. Not Lam.

P. scoparium minor Scribn. Bul. Univ. Tenn. 7: 48. 1894. Not *P. capillare minor* Muhl. 1817.

The synonymy is arranged chronologically and both names are untenable. I believe that the fact that Mr. Nash chose *scribnerianum* for the new name is sufficient evidence to show that he intended to change the name of *P. scoparium minor* Scribn., and hence the type of the former is also the type of the latter, namely, a specimen from middle Tennessee collected by Gattinger.

Others may hold that the new name must rest upon the type of the plant described by Watson, since this is the first synonym cited. A reference to Watson's description shows that *P. pauciflorum* is given as a synonym in the 6th edition of the 'Manual'; that the description is identical with that under *P. pauciflorum* Ell.? of previous editions back to the first; that in the first edition the range is given as N. Pennsylvania (Carey) and W. New York to Michigan. In this case Carey's specimen becomes the type of the species doubtfully referred to *P. pauciflorum* Ell. by Gray and also the type of *P. scribnerianum* Nash.

(*c*) *Panicum minus* (Muhl.) Nash. Bul. Torr. Bot. Club. 22: 421. 1895.

P. diffusum Pursh 1814. Not Swartz 1788.

P. capillare minus Muhl. 1817.

P. philadelphicum Bernh. 1829.

Mr. Nash then describes his plant briefly, but sufficiently to show that it is not Muhlenberg's plant, but *P. capillare minimum* Engelm. Nevertheless, the type of *P. minus* (Muhl.) Nash must be that of *P. capillare minus* Muhl. (which, by the way, was not thus published by Muhlenberg), as there is primarily a change of name. It might be argued that *P. diffusum* Pursh is also a typonym of *P. minus* Nash. If Mr. Nash had given an entirely new name to *P. diffusum* Pursh, then the new name would have been a typonym of *P. diffusum,* but he chose to take up another name founded upon a different type, in which case *P. minus* Nash and *P. diffusum* are synonyms or at least supposed to be, but they are not typonyms.

(*d*) *Dactylis cynosuroides* L. Spec. 71. 1753.

Linnæus gives first a description of his own apparently based upon the specimen in his herbarium, which is *Spartina polystachya* Willd.; second, a citation from Gronovius Flora Virginica, which is supported by a specimen of *Spartina polystachya* Willd. in his herbarium; thirdly, a variety β which is *Spartina glabra* Muhl. The localities given are Virginia, Canada, Lusitania. All the evidence here is in one direction, and the type specimen is the one in the Linnæan herbarium. Michaux next transfers this to his genus *Trachynotia* as *T. cynosuroides.* As he uses the specific name *cynosuroides,* and quotes as

synonym *Dactylis cynosuroides* L., we must consider this as primarily a change of name, although the plant he describes comes from Hudson Bay, and probably is *Spartina cynosuroides* as generally understood, that is, the plant from the interior, with few spikes.

Spartina cynosuroides Willd. Enum. 1: 80. 1809, must also be considered as a typonym of *Dactylis cynosuroides* L., since it is primarily a change of name. The description also applies. The two synonyms cited are *D. cynosuroides* Willd. Sp. 1: 40, which is based on Ait. Hort. Kew. 1: 103, which in its turn is based on *Dactylis cynosuroides* L. sp. 2d Ed. 104, and secondly upon *Trachynotia cynosuroides* Michx.

It is evident that Michaux took up Linnæus' name for the wrong plant, and his two species *T. cynosuroides* and *T. polystachya* must stand as synonyms. This leaves without a name the plant which Michaux describes under *T. cynosuroides*.

It is not best to be too arbitrary in deciding such cases and thus be led into an absurdity. This is particularly true for Linnæan species, as the conditions are unusual. Linnæus is introducing a new system and gives specific names to a large number of plants already well known. Judgment should be used so that a blind following of rules will not lead us into untenable positions. The American species are quite likely to be based upon type specimens which agree with his description. If there is no specimen in the Linnæan Herbarium the type should be traced, if possible, to a definite plate. If there are no plates and there is a conflict of cited descriptions, much care and study may be necessary in deciding upon what shall be a substitute for the type.

It is to be noted that there are many species of plants for which there are no nomenclatorial types. Only a few of Walter's grasses described in his 'Flora Caroliniana' are preserved in his herbarium now deposited in the British Museum. Names of species not represented in this collection are based upon descriptions and one can only say there is no type specimen. It may be that there is not in existence the type specimen of a species, according to the rules quoted, yet there may be other specimens which for practical purposes may take the place of the type. Many type specimens were lost at the time Professor Scribner's herbarium was destroyed by fire. Where there are duplicate types (specimens of a set or series bearing the same number or other data to show that they are a part of the same series) one of these may be chosen. It may be necessary to select a second or subsequently cited specimen to take the place of the type, when the latter is known to be lost. In all cases such a selection should be done by a monographer who has had opportunity to give the matter careful study.

A type specimen may consist of more than one individual plant. Consequently portions of the type specimen may be deposited in different places. In the National Herbarium are portions of the types of many species of grasses, such as those of Trinius, Muhlenberg and Elliott, sometimes consisting of an individual, more often of spikelets. These cases should not be confused with those mentioned above, where a description may have been drawn from all the specimens of a given number, one of which was retained in the author's herbarium and the remainder distributed. It would seem better, here, to distinguish the specimen or sheet of specimens in the author's herbarium as the type.

Finally, the following suggestions as to nomenclature are submitted:

Duplicate type: Specimens of the same series or set as the type as indicated by the number or other data.

Co-type: A specimen cited with the original description in addition to the type specimen.

A. S. Hitchcock.

U. S. Department of Agriculture.

CURRENT NOTES ON METEOROLOGY.

Mountain Sickness in the Sikhim Himalaya.

Although much has been written about the physiological effects of high altitudes, every new contribution to the subject is of interest. In a recent account of 'The Sikhim Himalaya' (*Scot. Geogr. Mag.*, April, 1905), Mr. Douglas W. Freshfield gives the following summary of his party's experiences: Mountain