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CONTENTS.

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SCIENTIFIC SURVEYS OF THE PHILIPPINE ISLANDS.

MESSAGE FROM THE PRESIDENT OF THE UNITED STATES.

To the Senate and House of Representatives:

Circumstances have placed under the control of this government the Philippine Archipelago. The islands of that group present as many interesting and novel questions with respect to their ethnology, their fauna and flora, and their geology and mineral resources as any region in the world. At my request, the National Academy of Sciences appointed a committee to consider and report upon the desirability of instituting scientific explorations of the Philippine Islands. The report of this committee, together with the report of the Board of Scientific Surveys of the Philippine Islands, including draft of a bill providing for surveys of the Philippine Islands, which board was appointed by me, after receiving the report of the committee appointed by the National Academy of Sciences, with instructions to prepare such estimates and make such suggestions as might appear to it pertinent in the circumstances, accompanies this message.

The scientific surveys which should be undertaken go far beyond any surveys or explorations which the government of the Philippine Islands, however completely self-supporting, could be expected to make. The surveys, while of course beneficial to the people of the Philippine Islands, should be undertaken as a national work for the information not merely of the people of the

Philippine Islands, but of the people of this country and of the world. Only preliminary explorations have yet been made in the archipelago, and it should be a matter of pride to the government of the United States fully to investigate and to describe the entire region. So far as may be convenient and practical, the work of this survey should be conducted in harmony with that of the proper bureaus of the government of the Philippines, but it should not be under the control of the authorities in the Philippine Islands, for it should be undertaken as a national work and subject to a board to be appointed by Congress or the President. The plan transmitted recommends simultaneous surveys in different branches of research, organized on a cooperative system. This would tend to completeness, avoid duplication, and render the work more economical than if the exploration were undertaken piecemeal. No such organized surveys have ever yet been attempted anywhere, but the idea is in harmony with modern scientific and industrial methods.

I recommend, therefore, that provision be made for the appointment of a board of surveys to superintend the national surveys and explorations to be made in the Philippine Islands, and that appropriation be made from time to time to meet the necessary expenses of such investigation. It is not probable that the survey would be completed in a less period that that of eight or ten years, but it is well that it should be begun in the near future. The Philippine Commission and those responsible for the Philippine government are properly anxious that this survey should not be considered as an expense of that government, but should be carried on and treated as a national duty in the interests of science.

Theodore Roosevelt.

The White House,
February 7, 1905.

Report of the Committee of the National Academy of Sciences.

1. *Need for Comprehensive Work.*—The primary incentive to scientific exploration of the Philippine Islands, as of any other region, is a desire to promote the commercial and industrial welfare of the inhabitants, and this purpose should never be lost sight of. Experience shows that this end is best attained by a comprehensive investigation of facts and conditions undertaken in a broadly scientific spirit. Millions of dollars have been spent in searching for coal in regions where the rocks are far older than the coal measures; it was the seemingly unpractical science of paleontology which put a stop to this waste and enabled geologists to outline the areas to which valuable coal fields are limited. So, too, antiseptic surgery is an application of recondite branches of botany and chemistry. The vast benefits which the Agricultural Department and the Fish Commission have conferred upon our country are founded upon the untiring labors of zoologists, botanists and chemists whose sole purpose was to elucidate the truth; and long after Franklin took the first step in the science of electricity economic applications of the knowledge acquired were almost undreamed of. In short, modern industrial development is an outgrowth of pure science, and almost every discovery of science is ultimately turned to economic account. Hence it would be short-sighted not to extend to the Philippines the broad and generous spirit of research which animates the governmental scientific work of the United States.

The main object to be sought in planning explorations of the Philippines is not to suggest new or unusual subjects of study or methods of study, but to provide against duplication of work, and to arrange for such cooperation between the officers engaged in different branches of the Scien-

tific Surveys as will insure rapid, satisfactory and economical progress in a noble contribution to human knowledge.

Since the United States is engaged in the first serious attempt to develop an Anglo-Saxon civilization in the tropics, and among a non-Aryan people, it may not be amiss to call attention to the effect on the enlightenment and culture of the Filipinos which systematically undertaken scientific surveys must inevitably produce. Such explorations will be a practical lesson in the application and value of learning.

2. *Resources of the Islands.*—The Philippine Islands form an extreme portion of one of the most interesting areas in the world, viz., Malaysia. The archipelago lies along the edge of the great and permanent abyss of the Pacific Ocean, forming the last bulwark of the Asiatic continent towards the southeast. This geographical position, half-way between Japan and Australia, with the China Sea on one side and the Pacific on the other, is most favorable to the development of a great commerce, which, indeed, the Philippine Islands once enjoyed.

The archipelago has not always been separated from Borneo, Java, Sumatra and the Peninsula of Malacca; on the contrary, land connections throughout this area existed at various times in its geological history. It is also probable that at one time Luzon and Formosa were connected. The islands themselves have undergone many geological vicissitudes, still indicated in part by the belts of extinct and active volcanoes which intersect them.

Gold veins, seemingly of very ancient origin, are widely distributed in the islands, though no great gold field is known to exist there; and there are some valuable copper deposits. The Philippines contain also important deposits of mineral fuel similar to the so-called coals of Japan and Borneo—a good quality of lignite—upon which much of the industrial development of the islands must depend. It is well known that the fertility of the Philippines is astonishingly great. This is due primarily to a favorable admixture of various igneous rocks with limestones and sandstones. In the moist and equable climate of the archipelago the rocks are rapidly converted into soil, while the absence of cold and drought results in a vigorous growth of roots, which protects the soil, as soon as formed, from rapid erosion by the heavy rains. One evidence of the fertility of the land is the presence of superb hardwood forests. These have been estimated to cover at least a third of the area of the islands, or, say, forty thousand square miles, and they include nearly two hundred species of valuable timber trees. All tropical crops will grow in the Philippines, while that very important plant (*Musa textilis*) which yields the so-called manila hemp, flourishes best in the archipelago. The resources of the islands have been very imperfectly developed; indeed, under Spanish rule, attempts at industrial progress usually met with disfavor. After the establishment of a well-ordered peace, the first step in progress must be the accumulation and dissemination of accurate and systematic information.

3. *Need of Coordination.*—In order rapidly and economically to provide the information desired, it is essential that the various branches of the work should be coordinated, for they are to a considerable extent interdependent; for example, topographical maps, which are an indispensable preliminary to geological mapping, are also required for planning highways, for military purposes, for the Land Office, for the Bureau of Forestry and for other ends.

It will be necessary in the Philippines, as elsewhere, to map some regions on a larger scale than others. Simple relations between the several scales used should be

maintained, as is done in the topographical mapping of the United States. In selecting the scale for any region the uses to which the map is to be put should be well considered and the survey made with an amount of detail adequate to the use in view. A naval station, an army post, or the location of a possible canal should be surveyed in greater detail than would elsewhere suffice. It seems entirely practicable to foresee the probable development of a system of highways, since these are largely controlled by natural conditions, and there is no reason why the development of means of communication should not be taken into consideration in the original surveys. The mapping of each area should thus be undertaken on such a scale as will suffice for the several purposes to which the government expects to apply the maps. Similarly, geological work should be done not merely with a view to elucidating the physical and biological history of the archipelago, or even to describing the mineral resources of the islands; the origin of soils, the occurrence of road metal and the facilities for or the obstacles to the cutting of canals, tunnels, or roads should be systematically reported upon from a geological point of view. Indeed it is manifest that assistance can and should be rendered by each branch of a complete survey to one or more coordinate branches. For this reason a plan of cooperation will be suggested somewhat later.

4. *Scope of Inquiry.*—The subjects which it is advisable for the government to investigate in the Philippines may be grouped as follows:

Coast and geodetic work and marine hydrography.
Land topography, including surveys and classification of the public land.
Geology and mineral resources.
Botany.
Problems of forestry.
Zoology.
Anthropology.

All of these subjects may be embraced under the general term scientific explorations, and their study may be carried to a satisfactory degree of completion in a few years.

Several other lines of inquiry are omitted from the enumeration, although they also are of great importance in the economic development of the islands. They are chiefly of local interest, and are largely administrative, but are permanent in character. They include meteorology, sanitation, the study of animal parasites, insect pests and the fungous diseases of plants, as well as sylvicultural and administrative forestry and the establishment of agricultural experiment stations and of zoological and botanical gardens. These lines of investigation have already been initiated and more or less fully provided for by the civil government of the Philippine Islands. The scientific surveys would naturally cooperate as far as possible with the insular scientific bureaus to the great advantage of both.

These several branches of the inquiry will furnish contributions to human knowledge, the importance of which will probably stand in the following order: Zoology, anthropology, botany, forestry, geology.

5. *Coast and Geodetic Work.*—The first step to be taken in the survey of the Philippines is the establishment of geographical stations and a primary triangulation. The position of Manila Observatory is of course well known, and many other points have doubtless been well determined, but the accuracy of existing determinations should be checked and the network completed. The land area of the archipelago is not large—only about 120,000 square miles—but because of its distribution in several hundred islands the area to be triangulated is far larger.

The importance of marine hydrography requires no emphasis further than to recall

the accidents and disasters which have occurred in the Philippine Islands since the American occupation for lack of adequate surveys and charts. It seems eminently desirable that, as fast as the triangulation is sufficiently advanced, a survey should be made of the very extensive shore line of the archipelago by a corps of marine hydrographers. These can determine better than topographers the amount of detail desirable in the line common to land and marine surveys. The line so determined should be accepted by both corps, and from it the hydrographers should work seaward and the topographers inland. The hydrographers will meet with especial difficulties on account of the innumerable coral reefs in the Philippine waters, and may also have trouble with recent uplifts, such as are alleged to have taken place within a few years in the Island of Paragua. There and elsewhere bench-marks should be established.

The Coast and Geodetic Survey has already begun work in the Philippines. It has occupied twenty-eight well-distributed astronomical stations, all in telegraphic communication with Manila, commenced a considerable number of harbor surveys, and initiated tidal observations at numerous points. It has also planned more extensive operations.

6. *Topography.*—Topographic work in the mountainous and wooded portions of the Philippines will be extremely difficult, the vegetation being so dense as to form an almost complete obstacle to vision and to free locomotion. However, in various portions of the archipelago, extensive open plains exist which can be rapidly mapped. It will probably be found that the native Filipinos will readily adapt themselves to topographical work, and, as they are extraordinarily agile, they will be of great assistance in the mountains and the forests. It is in the highest degree desirable that the surveys and subdivisions of the public lands should be committed to a topographical corps, such as that of the Geological Survey, as has been done, for example, in the Indian Territory. The topographical maps should show forest areas, but the discrimination of agricultural and mineral lands is not contemplated. As has been already noted, the scales employed should answer to the prospective uses to which the topographical maps are to be applied.

7. *Geology.*—The geological problems to be solved are numerous. The economic question of greatest moment is the stratigraphy of the coal-bearing Eocene formation, which is most extensively developed in southeastern Luzon (Albay and Sorsogon) and the Island of Cebu. It is probable, but not certain, that the coal deposits of Mindanao belong to the same period. The Eocene has been much disturbed and considerably faulted, so that its study will be a somewhat serious task. The coral reefs, volcanoes and earthquakes will necessarily also demand the attention of geologists.

The dense vegetation of the tropics offers great obstacles to the study of geology, and in the Philippines the lack of roads will also delay the work. There is, however, one set of exposures which are admirable and of vast extent, as well as readily accessible by proper means. It has been estimated that there are over eleven thousand miles of seacoast, without counting minor indentations, and along most of this line the rocks are exposed by wave action. The study of the geology of the country will probably proceed most rapidly if begun from boats along these coasts, and in beginning geological work on any of the smaller islands it will probably be expedient, as well as most economical, first to circumnavigate the island in steam-launches, mapping the exposures with care. With the information thus obtained it will be

comparatively easy to extend the surveys into the interior.

The geological formations of the East Indies, including Malaysia, are as yet imperfectly correlated with those of Europe. The distance separating these two regions is so great, and the intervening land mass with its peculiar mountain systems is so immense, as easily to account for extreme differences in fossil remains, rendering it difficult to correlate the two systems. On the other hand, in America, where the mountains and coasts have a southerly trend, formations can be followed from the temperate zone into the tropics with no great difficulty, and a definite correlation has thus been obtained. Hence it is advisable that the geologists, and especially the paleontologists, who may be sent to the Philippines, should have familiarized themselves with the geology of the marine strata of the West Indies and the Gulf of Mexico. In some respects knowledge of the geology of the tropics is of more importance in the elucidation of the earth's history than that of the temperate zone. Climatic conditions along the equator must always have been more equable than in the temperate zone, and the development of life must have been less affected by changes in local conditions. Hence near the equator, if anywhere, will be found evidence of variations in the climate of the earth as a whole in earlier geological times, variations such as may have been due to changes in solar emanation or in the composition of the earth's atmosphere.

Attention has already been called to the fact that geologists should systematically lend assistance in the study of soils and in the development of a system of highways.

8. *Zoology and Botany.*—The Philippines have long been an attractive field for the student of natural history, and some of the most important theories respecting the origin, distribution and coloration of animals and plants have resulted from studies in this region. It was chiefly from observations of the insects of the archipelago that Wallace discovered the law of natural selection independently of Darwin, who had not then published his 'Origin of Species.' But the fauna and flora are still very imperfectly known. Field work in ornithology has been more thorough than in the other lines; nevertheless, several of the larger islands have been only slightly explored, and some of the smaller ones not at all. A small collection of mammals made by a bird collector on Mount Data, in northern Luzon, comprising only such species as were brought to him alive by the natives, contained half a dozen new generic groups. This may be taken as a promise of what will be learned when the numerous lofty mountains of the larger islands are systematically explored. Heretofore most of the natural-history work has been along the coast and larger rivers. In future the most promising and important field, and also the most difficult so far as land species are concerned, is in the highlands of the interior.

The fauna of the Philippines is complex in origin and heterogeneous in character. It consists of types originally derived in part from the south (Borneo, Celebes and the Moluccas) and in part from the north (Formosa and southeastern China); hence it is not surprising that the animals and plants of certain islands differ widely from those of other islands. It is important that the fauna and flora of each island be studied in detail, and that the zoological work include mammals, birds, reptiles, batrachians, fishes, insects and marine invertebrates; and that the botanical work include, besides systematic botany, the study and identification of the food plants, fiber plants and medicinal plants used by the native tribes.

In each of these departments the work

should be under a trained naturalist, competent to supervise the field work, make the necessary technical studies and prepare the report relating to his own special line. The chief object of the work should be a complete and authoritative report on the fauna and flora of the islands, comprising descriptions of all the species, with a statement of their geographical ranges. This will lead to a natural classification of the islands according to the origin of the faunas and their relationship to one another and to those of adjacent islands. Attempts thus to group the islands have been made by Wallace, Steere, Worcester and others, but as yet the faunas and floras are too little known to admit of final judgment.

9. *Forestry.*—The subject of forestry in the Philippines is one which is both of deep scientific interest and of great importance in the economic development of the islands. A local bureau of forestry has already been instituted by the Philippine Commission, and this will undoubtedly be a permanent organization. It will be needed to protect, control and foster the extremely valuable timber resources of the islands, and it is already doing good work. There are, however, certain fundamental facts and relations in connection with the forests which can be ascertained only by a thorough scientific investigation, which is beyond the scope of the local bureau. These studies can be completed within a few years, with the certainty that the knowledge obtained will be of lasting benefit to the local bureau of forestry; and the investigation of these subjects properly belongs to a scientific survey of the archipelago. Such subjects are the sylvicultural organization of the forests; periodicity of growth in tropical trees; processes of seed-bearing, seed-distribution and germination; growth and competition in early life; the influence of moisture and temperature on the tropical forest and the influence of the forest on moisture and temperature. While forestry is, strictly speaking, a branch of botany, its methods are peculiar and it will be expedient to treat it as a separate branch of the scientific surveys.

10. *Anthropology.*—Although little is known of the archeology and ethnology of the Philippines, there are sufficient reasons for believing that, in these two closely related lines of research, facts of the greatest importance will be discovered in the archipelago. Indeed it is probable that in southeastern Asia or in the adjacent insular regions the remains of fossil man will be found. The discovery of bones of *Pithecanthropus erectus,* that strange ape-like man or man-like ape, in the Pliocene formation of the Island of Java, leads to the expectation that systematic research in the deposits marking the beginning of the Quaternary period in the Philippines will yield the remains and probably the works of man, and thus throw light on the subject of early man in Asia. The small amount of archeological research thus far accomplished in the islands has already revealed evidence of an apparently aboriginal people differing from the Negritos.

This Negrito race of the islands, with its closest affinities on the Malay Peninsula and the Andaman Islands, offers a problem of exceeding interest and scientific importance. Where did this Negrito race originate? Is it a distinct primitive type that has persisted in the outlying regions of the Asiatic continent? or is it a differentiated branch of a widely extended primitive race or species of man? These and other important questions may not improbably be answered by an extended anthropological survey of the Philippines.

Linguistic studies of the widest scope should be pursued on the islands. The myths and folk-lore of the various tribes should receive the attention now demanded by the requirements of science. Collections

of archeological material also should be secured as a means of studying the early status of man on the islands; and the effect that the later intrusions have had on the aboriginal peoples ought to be ascertained by a thorough study of the customs, arts and mental characteristics of the many and diversified tribes.

Knowledge of these matters is essential in order that the proper method of dealing with the natives may be determined. The honor of the United States demands that every means be taken to avoid mistakes of ignorance in dealing with the vast and relatively helpless population of these islands. This first attempt of the United States to bring alien races of the tropics into the fold of Anglo-Saxon civilization should be guided by strictly scientific data and principles. This necessitates, first, thorough knowledge of the peoples to be assisted, and then measures which accord with their various customs and their capabilities. Only a thoroughly scientific anthropological survey can provide the information required for the attainment of enlightenment and humane results.

11. *Collections and Their Disposition.*—Each special survey should cooperate as far as practicable with other branches of the service in the collection of specimens, and be ready to afford them all facilities not incompatible with its own efficiency.

The specimens collected will be the property of the United States. The first series, including all type specimens, should be deposited in the United States National Museum. A series of duplicates should be deposited in a local museum in the Philippines, such museum to be designated by the Philippine Commission. Other duplicates, if there be any, should be distributed to such leading museums, desiring collections of this character, as by reason of permanent endowments are able properly to care for and preserve the specimens.

12. *Comparative Studies in Adjacent Islands.*—For the purposes of the contemplated surveys Malaysia as a whole constitutes a convenient geological and biological province. A very large amount of valuable scientific investigation has been accomplished in other portions of Malaysia, particularly by Dutch geologists and naturalists. Some of the questions arising in the Philippines can not be satisfactorily settled without comparison of the occurrences in the archipelago with those in adjacent islands. Hence this committee is of opinion that general permission should be granted to the scientific surveys of the Philippine Islands to send observers, from time to time and for brief periods, to neighboring islands for the purpose of making comparative studies. Great saving of time and great increase in efficiency would result from such a provision.

13. *Administration.*—The scientific history of the United States during the last fifty years demonstrates the value of unification and systematic organization in such surveys as are contemplated in this report. The state geological surveys were manned by able and industrious observers, but there was a lack of unity of method and a lack of unity of aim, which made it nearly impossible to correlate their results. No one familiar with the subject will question the statement that the country as well as the science of geology has profited by the extension of the United States Geological Survey over the entire country. The national scientific bureaus have, laboriously and after long experience, developed methods of work and staffs of assistants which are at least equal to any in the world. To develop in the Philippines a separate set of similar bureaus would require much time and loss of time. Nor would employment in such bureaus be attractive; for prolonged service in the tropics is so trying to most constitutions that the number of

competent men willing to accept permanent positions there will probably not exceed the demand of the insular administrative bureaus to which reference has been made in a preceding paragraph. On the other hand, there seems no essential difficulty in embracing this area, like any other territory of the United States, in the fields occupied by existing national bureaus. Members of these organizations would be willing to be detailed for two or three years to so interesting a region as the Philippine Islands, with the prospect of resuming duty at home.

In order to secure cooperation and to preserve due proportions between the various surveys under the charge of the national bureaus, to arrange for suitable forms of publication of reports, prepare estimates, recommend legislation, determine upon the system of measurements, and to settle other questions of common interest, there must be frequent consultations in Washington between the representatives of the various branches of the work. For this purpose it is suggested that a board of Philippine surveys be created and put in charge of the work. It is manifestly of the utmost importance that such a board should be composed exclusively of eminent scientific experts, who alone are competent to direct the work. For administrative reasons it is essential that the board should consist of officers selected from the national scientific bureaus, and in the opinion of the committee these should be:

Superintendent of United States Coast and Geodetic Survey.

Director of United States Geological Survey.

Chief of United States Biological Survey.

Botanist of United States Department of Agriculture.

Chief of Bureau of Forestry.

Chief of Scientific Staff of Fish Commission.

Chief of Bureau of American Ethnology.

From these members one should be appointed chairman by the President, with the consent of the Senate, and the chairman should report to the President. There are precedents for such an organization in the Smithsonian Institution and in the boards of commissioners appointed to represent the government at various expositions.

The chief necessary expense of such a board would be a very moderate sum for clerical assistance; but it would probably be expedient and economical for the board to employ an officer, to be stationed at Manila, to perform functions analogous to those of quartermaster and commissary for all field parties, which will have many material wants in common.

While the methods of work and the selection of men should be left to the chiefs of the national scientific bureaus, viz., the members of the Board of Philippine Surveys, much latitude must be allowed the officers in charge of field work in so remote and exceptional a region as the Philippine Islands. On the other hand, if these officers are left entirely to their own judgment as to areas in which work is to be done in any given season, and as to the amount of detail requisite, there will be danger of lack of harmony in the results and delay in the progress of the work. To insure cooperation and to avoid duplication in the field work the following plan is suggested:

Let a scientific council be created in the Philippine Islands, presided over by a member of the Philippine Commission, to consist of the chief field officers of the several scientific bureaus present in the islands, as follows:

One geodesist, designated by the superintendent of the Coast Survey.

One hydrographer, designated by the superintendent of the Coast Survey.

One topographer, designated by the director of the Geological Survey.

One geologist, designated by the director of the Geological Survey.

One zoologist, designated by the chief of the Biological Survey.

One botanist, designated by the botanist of the Department of Agriculture.

One forester, designated by the chief of the Bureau of Forestry.

One anthropologist, designated by the chief of the Bureau of American Ethnology.

with whom should be associated one officer of Engineers, U. S. A., and one naval officer. Let this council meet once each year, for example, towards the close of the rainy season, and decide, in the interests of the Philippine surveys as a whole, what areas each bureau shall take up during the ensuing season, and with what degree of detail. It is believed that such a council would deal satisfactorily with all matters which might come before it, without lack of due regard to the expert opinions of the chief officers affected. In case of dissatisfaction, however, an appeal might be allowed to the governor-general. The findings of the council should be regularly reported to the Board of Philippine Surveys in Washington.

14. *Aid from Army and Navy.*—Except at the largest towns, it is seldom possible in the Philippines to obtain clothing or food such as Americans are accustomed to, and transportation facilities are very limited. For this reason it is recommended that the officers of the scientific surveys be granted permission to purchase supplies at military depots, such as army posts and naval vessels, and to avail themselves of opportunities of transportation on vessels attached to either service when such accommodation can be afforded without detriment to the military service.

15. *Cost and Time.*—This committee is not in a position to offer estimates of the cost of Philippine surveys. These could be easily furnished by the chief officers of the various scientific bureaus. It is believed, however, that with a moderate number of parties in each branch, under the system of cooperation recommended in this report, nearly all the work of exploration outlined above would be completed in a period of ten years, including charts, topographical maps and geological maps.

16. *Order of Importance.*—Should it be impracticable to organize the entire system of surveys simultaneously, it is recommended that they receive attention in the following order:

Coast and geodetic work and marine hydrography.

Land topography, including surveys and classification of the public lands.

Geology and mineral resources.

Botany.

Systematic forestry.

Zoology.

Anthropology.

This report was adopted by the committee on February 7, 1903.

William H. Brewer,
Chairman.
George F. Becker,
Secretary.
C. Hart Merriam.
F. W. Putnam.
R. S. Woodward.

ANTHROPOLOGY AND ITS LARGER PROBLEMS.

Youngest in the sisterhood of sciences, anthropology borrows principles and methods from all the older branches of knowledge; and her first problem—a problem renewed with each step of advance and hence endless as the problem of quarry to the huntsman or of crop to the planter—is that of determining her own relations in the realm of knowledge, her own place and powers in the intellectual world.

Viewed in the light of history, it is no accident that anthropology is the youngest of the sciences; for it is the way of knowledge to begin with the remote and come down to the near—to start with the stars, linger amid the mountains, rest awhile