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Systematic Notes on Palearctic Birds. No. 29 The Subfamilies Tichodromadinae and Sittinae

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The present paper is a discussion of *Tichodroma muraria* and of some species of *Sitta* that were studied in the preparation of a contemplated check list of the Palearctic avifauna. The family relationships of *Tichodroma* are discussed, as well as the wider family relationships in the group of birds to which these genera belong. Among the notes on the various species the major part is occupied by a review of *Sitta europaea*.

I would like to express my gratitude for cordial help received from a number of individuals. To Dr. Dean Amadon, with whom I have discussed the question of family relationships, to Dr. Kenneth C. Parkes for discussing *S. canadensis*, to Dr. Holger Holgersen, who has kindly lent me material from the Stavanger Museum in Norway, to Dr. Robert W. Storer, who has likewise lent me material from the Museum of Zoology of the University of Michigan, and to several Swiss colleagues. Professor H. Steiner of Zurich in the course of conversation told me that he believed *Tichodroma* was better placed with the nuthatches than with the creepers. Dr. E. Sutter of Basel called my attention to similarities in the breeding biology of *Tichodroma* and *Sitta*. On my behalf he asked the opinions of field ornithologists in Switzerland, among them Mr. M. Schwarz of Basel who is an expert on bird voices, and M. Paul G eroudet of Geneva who wrote to me most cordially concerning his observations. I felt that these Swiss ornithologists were best placed to know *Tichodroma* in life, and it is a pleasure to acknowledge their cordial assistance.

After the present notes were written, I met Prof. L. A. Portenko, Dr. E. Stresemann, and Dr. H. Löhrl in Germany. Löhrl discussed with me several nuthatches that he has been studying in life, and I had many lengthy discussions with Portenko and Stresemann. Portenko also showed me much material that he had brought from the Soviet Union and presented me with several specimens. I benefited greatly by meeting these colleagues, and I acknowledge their cordial assistance with much pleasure.

TICHODROMA AND ITS FAMILY RELATIONSHIPS

The question of the family relationships of the Wall Creeper (*Tichodroma muraria*) is a difficult one, and its true position will probably remain more or less doubtful. Nevertheless, I am convinced that it is not closely related to the typical tree creepers (*Certhia*) and that, everything considered, it is best placed in the nuthatch family as a separate subfamily. Gadow and other authors placed *Tichodroma* in the Certhiidae, though it is interesting to note that Gadow included the nuthatches also in this family, dividing it into two subfamilies, the Sittinae and the Certhiinae, and placing *Tichodroma* in the latter. Hartert recognized two families and kept *Tichodroma* in the Certhiidae. This treatment has been followed until recently, although more than one author has questioned whether it was correct. For instance, the Heinecks (1924–1926, *Die Vögel Mitteleuropas*, Berlin, Hugo Bermühler, vol. 1, p. 134) stated flatly they did not agree with Hartert, pointing to a number of differences between *Tichodroma* and *Certhia* which they believed are important, namely, in the structure of the tail, wings, toes, and bill, the different coloration, and a considerable difference in the voice.

In 1950 (Amer. Mus. Novitates, no. 1472, pp. 1–2) I mentioned that I was impressed by the fact that in *Tichodroma* “the appearance and texture of its entire plumage including the shape and pattern of its tail” is closer to that of the nuthatches (*Sitta*) and that its habits resemble more those of the two rock nuthatches (*tephronota* and *neumayer*) than they do those of *Certhia*. I stated that it seemed best to me to place it in the Sittidae as a separate subfamily but that it is “decidedly intermediate” between the latter and the Certhiidae. The belief that *Tichodroma* is “intermediate” is widely held but may not be correct. Perhaps (and this view has been suggested to me by an observer who is familiar with the three genera in life) *Tichodroma* should be elevated to the rank of a full family. This treatment might be the closest approximation to the truth, but it is generally conceded that it

is not wise to recognize full families among the passerine birds if these families contain only one species.

The list Committee of the British Ornithologists' Union, which presumably considered this question, placed *Tichodroma* in the Sittidae (1952, Check-list of the birds of Great Britain and Ireland, London, British Ornithologists' Union, p. 69), but Meinertzhagen and Williamson (1953, *Ibis*, p. 367), commenting on this decision and my 1950 paper, state they believe it is best to retain *Tichodroma* in the Certhiidae. The reasons they advance are considered below.

STRUCTURAL CHARACTERS

The texture and coloration of the body plumage in *Tichodroma*, the shape and structure of the feathers, and the color pattern of the tail are identical or very much closer to those of *Sitta* than they are to those of *Certhia*. The Wall Creeper even possesses white tips on its tail feathers as does *Sitta*, but these similarities, which are really quite striking, are dismissed by Meinertzhagen and Williamson as being merely adaptive or possibly due to convergence. They think that the shape of the bill and the feeding habits with which it is correlated are probably equally reliable as a clue to relationship, and they add: "We think that more importance should attach to the rounded wing with long first primary in *Tichodroma* and *Certhia*, as against the pointed wing with minute first primary in *Sitta*; the shape of the nostrils, rounded and concealed by bristly feathers in *Sitta*, slit-like and exposed in the other genera; and the presence of rictal bristles in *Sitta* alone. Moreover, the call and song of the Wall Creeper are quite unlike those of the Nuthatches and more nearly approach the more subdued utterances of the Tree Creepers."

However, if we examine the wing of the two rock nuthatches, we find that it is the same as in *Tichodroma*, including the presence of a long first primary. This may be an instance of adaptation or convergence, but the same may be true of the shapes of the bill and nostrils. Moreover, though the bills of *Tichodroma* and *Certhia* are superficially similar, they differ quite distinctly in structure as mentioned by the Heinroths. We are left with the slit-like nostrils and the lack of rictal bristles, though it should be mentioned that the rictal bristles are really vestigial in *Sitta*. It is difficult to know what these characters signify as clues to relationships, because one can point to structural similarities between *Sitta* and *Certhia* which could be used as arguments that they are closely related, whereas *Tichodroma*, which differs from both very clearly in these characters, could be said to be unrelated to either. For

instance, the tarsus is well scutellated in *Sitta* and *Certhia*, and they have similar tongues, which end in a number of bristle-like filaments (see Gardner, 1925, Proc. U. S. Natl. Mus., vol. 67, art. 9, figs. 113, 121-122). In *Tichodroma*, however, the tarsus is not scutellated but covered instead by a single long lamina, and according to Witherby *et alii* (1938, Handbook of British birds, vol. 1, p. 238) the tip of the tongue has no bristles. The toes are dissimilar in all three genera, and *Tichodroma* has a double molt whereas *Sitta* and *Certhia* have only one.

In short, one must weigh the evidence which shows that *Tichodroma*, though well differentiated from either *Sitta* or *Certhia*, possesses more characters in common with *Sitta*. These include the texture and the coloration of the body plumage which seem to be characters of basic importance in some groups of passerine birds. The structure of the tail and its color pattern seem significant also.

HABITS AND VOICE

All three genera are climbers, but while *Certhia* is strictly arboreal, *Tichodroma* and *Sitta* occasionally come to the ground, and the habits of the Wall Creeper and the two rock nuthatches appear to be very much the same. In fact, the more one compares these birds, the more difficult it becomes to dismiss the possibility that the Wall Creeper is perhaps only a specialized derivative of some such bird as the rock nuthatch.

There is so much disagreement in the literature and in the opinions of field observers concerning the utterances of the Wall Creeper that it is difficult to draw conclusions. Generally speaking, however, most observers discern a vague similarity between *Certhia* and *Tichodroma*, but other observers are of the opinion that the voice of the Wall Creeper differs much from that of *Certhia* or *Sitta*. In view of the lack of clear-cut similarities, the voice is probably not a good clue.

PHYSIOLOGY

In *Tichodroma* and *Sitta*, incubation is done only by the female but by both sexes in *Certhia*, though its two best-known species differ to some extent. In *C. brachydactyla* the incubation is shared equally, but in *C. familiaris*, although the male does incubate, most of the incubation appears to be done by the female. In *Certhia* the postembryonic development is much more rapid, lasting from 14 to 16 days, usually 15, whereas in *Sitta* it takes 23 to 25 days, and 26 or more in *Tichodroma*. Sutter, who has called my attention to this, remarks in a letter, "For a Passerine bird of this small size the nestling period is very long and one

might suppose a growth rate (and delayed feather development?) similar to that in *Sitta*."

It does not seem to me that the very marked difference in the development of the nestlings between *Certhia* and *Tichodroma* can be dismissed on the ground that *Tichodroma* nests in crevices, that is, is a hole nester as compared to *Certhia*. The latter never breeds in an uncovered nest in the open and in fact occasionally builds its nest in sites that do not differ essentially from those of the Wall Creeper. Moreover, some hole nesters that belong to the same general group as the Wall Creeper, such as the Titmice, have a nestling period shorter than that of *Sitta* or *Tichodroma*. In the Blue Tit, the nestling period can be as short as 15 days, though it is usually 19. It is possible that the delayed postembryonic development of the Wall Creeper, similar or even longer than that of *Sitta*, is another clue (and the same downy plumage?) that suggests that it is more closely related to *Sitta* than to *Certhia*.

WIDER FAMILY RELATIONSHIPS

Mayr and Amadon (1951, Amer. Mus. Novitates, no. 1496, pp. 23-24, 37) placed the creepers, nuthatches, and titmice in the same general group, suggesting affinities that have been long suspected. They recognized three families, the Certhiidae, Sittidae, and Paridae, dividing the latter two into three subfamilies each. The subfamilies of the Paridae (Aegithalinae, Remizinae, and Parinae) are discussed by me in another paper¹ in which I state that Delacour and I believe the first two should be removed and raised to the rank of families. The Sittidae are divided by Mayr and Amadon into the Salporninae (including *Rhabdornis* and *Climacteris*, which appear to be related, *Tichodroma*, and *Salpornis*), the Sittinae (including *Sitta*, *Neositta*, and *Daphoenositta*), and the Hyposittinae for the species *Hypositta corallirostris*.

The true affinities of some of these genera are not clear, however, and Mayr and Amadon emphasize that their arrangement of the Sittidae is tentative only, stating, "This family, as we conceive it, is admittedly something of a 'scrap basket.'" *Salpornis* (India and Africa) and *Neositta* (Australo-Papua), which build exposed, cup-shaped nests in the fork of a branch, are probably not related to the nuthatches or true creepers, despite similar tree-running or creeping habits, while the nidification of *Daphoenositta* (Australo-Papua) and *Hypositta* (Madagascar) is unknown. *Salpornis* may not, however, be allied to *Neositta*,

¹ 1957, Amer. Mus. Novitates, No. 1853.

but Rand (1936, Auk, pp. 306-311), who discusses the affinities of *Neositta*, *Daphoenositta*, and *Hypositta*, believes the first two of these three are allied and places them in a subfamily (the Daphoenosittinae) of the nuthatches. *Hypositta*, which may belong to the same general group, is kept by Rand in a separate family.

It seems to me that a more satisfactory arrangement of these families could be reached than the several arrangements now followed if these four genera and the titmice, nuthatches, and true creepers, to which they are perhaps very distantly related, were divided into three families. One family, the Salpornidae (as *Salpornis* is the oldest genus), could group *Salpornis*, *Neositta*, *Daphoenositta*, and *Hypositta* in several subfamilies. Another family, the Paridae, would group the titmice, nuthatches, and the Wall Creeper arranged in the following order: Parinae, Sittinae, and Tichodromadinae, this last subfamily including also the hole nesters *Rhabdornis* and *Climacteris*. It has been customary for a long time to divide the titmice, nuthatches, and creepers into three families, but all along it has been recognized also that the nuthatches and titmice are allied. As Hartert remarks, the nuthatches are believed by many to be only a subfamily of the Paridae, though he preferred to keep them as separate families. It is possible that the affinities of the long-tailed tits (*Aegithalus*), which Delacour and myself are inclined to believe represent a separate family, are perhaps with the Paridae in which they could be placed as an additional subfamily, preceding the Parinae. The third family would be the Certhiidae. *Certhia* may be more or less distantly related to the nuthatches and titmice but is so specialized that it seems best to keep it as a separate family, including only the true tree creepers.

The question of the passerine families and their arrangement will be taken up again in the near future in a paper by Delacour and me.

SUBFAMILY TICHODROMADINAE

Tichodroma muraria

Geographical variation in the Wall Creeper has been discussed by me in an earlier paper (1950, Amer. Mus. Novitates, no. 1472, pp. 29-34) in which I concluded that only two subspecies can be recognized: a paler race (n nominate *muraria* Linnaeus, 1766, type locality, southern Europe, of which *longirostra* S. G. Gmelin, 1774, type locality, northern Iran, is a synonym), ranging from Europe to the Caucasus and northern and western Iran, and *nepalensis* Bonaparte, 1850, type locality, central Asia, inhabiting Asia east of nominate *muraria*. The latter shows also a tendency to have larger white spots on the wings and at the apex of

the tail feathers, to be a little paler and pinkish at the base of the tail, and in winter plumage to be slightly more yellowish ocher on the fore-crown. I emphasized that all the color differences vary individually, are slight to very slight, and that the general degree of saturation which is the most constant character is not well marked. I also mentioned that the mean wing length increases gradually as the populations range eastward, but that the bill length does not show any clear evidence of geographical variation, being most variable individually in the east. My measurements were analyzed statistically and presented individually and in a graph (fig. 4 in that paper).

The geographical variation of this species is discussed again because, since my study was published, Portenko (1954, Fauna U.S.S.R., no. 54, Birds, vol. 3, p. 130) has described a new form (*ognewi*) with type locality, Tashkent, and has published a subsequent and brief review of the species (1955, Trudy Zool. Inst. Akad. Nauk U.S.S.R., vol. 18, pp. 499-500) in which he recognizes four subspecies: nominate *muraria*, *longirostra*, *nepalensis*, and *ognewi*.

In this review, or in its original description, *ognewi* is not compared with *nepalensis*, although the distinguishing characters by which Portenko says it differs from nominate *muraria* and *longirostra* are precisely those by which *nepalensis* differs from the other two, namely, that *ognewi* is darker, more yellowish, on the crown in winter plumage, and darker. I believe, therefore, that Portenko has merely redescribed *nepalensis*, the type locality of which is "central Asia" and encompasses Tashkent in the broad sense. The measurements given by Portenko confirm my findings that the wing length increases as the populations range farther east and that no clear-cut evidence of geographical variation is shown by the length of the bill. They do not permit the separation of *ognewi*. In its original description the new form was compared in size only to *longirostra*, but, as shown below, its measurements show a very great overlap with those of "*longirostra*" or *nepalensis*.

Portenko has emphasized that the geographical variation of this species is slight and that the races are separable only in series, but most authors, such as Meinertzhagen (1938, Ibis, p. 671), believe that the variation, although it shows a geographical trend, is much too slight and inconstant to warrant its division into subspecies. Virtually all standard works consider *Tichodroma muraria* to be monotypic, but it is possible to recognize two slightly differentiated subspecies, as I concluded in 1950.

Measurements given by Portenko in 1955 are: males, wing and bill, length, nominate *muraria*, 97.5-99.8 (98.5), 23.9-29.7 (26.8); *longiros-*

tra, 95.7–102.4 (99.2), 21.9–29.5 (24.9); *ognewi*, 98.1–106.1 (101.5); 19.5–29.3 (24.0); *nepalensis*, 100.6–107.8 (103.8), 20.9–25.2 (22.9). Females measured by Portenko have a somewhat shorter wing than males, but the length of the bill is about the same.

SUBFAMILY SITTINAE

Sitta europaea

The European Nuthatch varies a great deal geographically and has been the subject of many studies, but it seems sufficient to mention only one paper, by Voous and Van Marle (1953, *Ardea*, vol. 41, suppl., pp. 1–68), as the literature is well covered by these authors in a list of 77 titles. Their paper is a detailed study of the evolutionary and distributional history of the entire species, with a discussion of all its races.

I think that Voous and Van Marle have recognized far too many subspecies. They recognized a total of 40, whereas it seems to me that it is sufficient to recognize only about half that number. I have recognized 26. Three of these (*seorsa*, *roseilia*, and *koelzi*) are not included in the 40 recognized by Voous and Van Marle. The area of disagreement between the treatment of these authors and my own is therefore very wide and does not involve merely the matter of subspecies. For instance, I cannot agree that it is evident that the two rock nuthatches (*tephronota* and *neumayer*) are an "offspring" of *europaea*, nor can I agree that *Neositta* of New Guinea and Australia is "a strongly diverged offshoot" of *leucopsis* and *carolinensis*. Indeed, as discussed above under family relationships, the systematic position of *Neositta* is quite uncertain. It is probably not a nuthatch at all. Mayr and Amadon (1951, *Amer. Mus. Novitates*, no. 1496, pp. 23–24) placed it in the same subfamily as *Sitta*, as stated above, but they did so only tentatively and with the strongest reservations, and now Amadon tells me that he agrees with me and doubts that *Neositta* belongs in that subfamily.

I also do not agree with the interpretation of some aspects of the clinal variation as interpreted by Voous and Van Marle, and it seems necessary to mention also that they are clearly incorrect when they state that in *S. europaea*, the Indian group (*castanea*) comes into contact with the *sinensis* group in southeastern Tibet. They emphasize this aspect of the distribution as being important in the evolutionary history of the species, but it is well known that in the Himalayas the *castanea* group is restricted to the southern foothills, or relatively low elevations, and that it does not occur north of the Himalayas and thus cannot come into contact with the *sinensis* group. Voous and Van Marle cite

Ludlow (1944, *Ibis*, pp. 71-74) as their authority, but Ludlow states only that he collected *cinnamoventris* (a race of the *castanea* group) at 1500 feet at Satsalor, adding that it was "common in tropical forest in the foothills. Observed at Kalimpong at 5000 ft., but not seen higher." In southeastern Tibet, Ludlow collected and reported only *tibetosinensis* (a form of the *sinensis* group), adding that it was "apparently confined to the northern slopes of the main range [of the Himalayas]." As Satsalor is in the low southern foothills of Bhutan, and Kalimpong is very near Darjeeling, only about 20 kilometers due east of it, Ludlow certainly did not observe nor collect *castanea* north of the Himalayas, which constitute a most effective barrier between the two groups.

Four groups of subspecies, representing different evolutionary lines, can be recognized in *europaea*, five if *castanea* is conspecific with it. All the races that I believe are valid in these five groups are listed below. For subspecific characters and ranges of the subspecies, see Voous and Van Marle.

A. THE NOMINATE *europaea* GROUP: The populations of this group are white on the lower throat and breast and vary from white or creamy to buffy brown on the abdomen.

1. *Sitta europaea europaea* Linnaeus, 1758, type locality, Sweden, with the following synonyms: *rossica* Dunajewski (1934, *Acta Ornith. Mus. Zool. Polonici*, vol. 1, p. 190), type locality, gouvernement of Kharkov, Ukraine; and *norvegica* Van Marle and Voous (1950, *Stavanger Mus. Årbok*, p. 69), type locality, southwestern Norway. *Norvegica* is identical with topotypical nominate *europaea* in males, but the females are darker and more buffy below, while in *rossica* both sexes are purer white below than in topotypical nominate *europaea* which shows a more or less slight creamy tinge. The material examined suggests that a cline of increasing paleness runs from west to east, but the geographical variation is slight, or relatively so, and not perfectly constant, as one of the two female paratypes of *norvegica* that I have examined is identical with females from Sweden, and one of two females from Voronezh, at the extreme eastern end of the range of *rossica*, is also identical with females from Sweden. I believe that it is sufficient to call attention to this variation without resorting to subspecific division, as Voous and Van Marle have done in the case of other populations that show about the same degree of clinal variation as do the populations ranging from Scandinavia to eastern Russia (see their treatment of *hassica*). This species is strictly resident, except perhaps in the far north, and throughout its range tends to show much evidence of local variation along

various clines, but this variation is usually very slight and should not serve in my opinion as the basis for subspecies.

I would like to express my appreciation here again to Dr. Holger Holgersen who kindly supplemented my material by lending me two female paratypes of *norvegica*, as well as other female and male specimens from southwestern Norway and from Uppsala in Sweden.

2. *Sitta europaea arctica* Buturlin, 1907, type locality, Verkhoyansk, eastern Siberia. A good character that differentiates this race from all others of the nominate *europaea* group, which has been brought to light by Voinstvenski (1954, Birds of the Soviet Union, vol. 5, p. 718), is that its wing tip is more pointed. In *arctica* the second outer primary is shorter, being equal to the seventh, instead of longer. *Arctica* shows also much larger white spots in the tail, particularly on the outer rectrices.

3. *Sitta europaea albifrons* Taczanowski, 1882, type locality, Kamchatka. The validity of this race has been questioned by Dementiev (1934, L'Oiseau, p. 624) and by Voinstvenski (*loc. cit.*) who does not mention it, not even as a synonym, referring the birds of Kamchatka to *asiatica*. However, I find that *albifrons* is a valid race, related to *arctica* in my opinion, but generally paler.

4. *Sitta europaea asiatica* Gould, 1837, type locality, Russia, with the following synonyms: *baicalensis* Taczanowski, 1882, type locality, Darasun, Transbaicalia¹; *clara* Stejneger, 1886, type locality, Hokkaido; *biedermanni* Reichenow, 1907, type locality, northern Russian Altai; *sakhalinensis* Buturlin, 1916, type locality, Sakhalin; *takatsukasai* Momiyama, 1931, type locality, southern Kuriles; and *partiaria* Portenko (1954, Fauna U.S.S.R., no. 54, Birds, vol. 3, p. 125), type locality, Sretensk, Transbaicalia.

Voous and Van Marle have used the name *biedermanni* instead of *asiatica*, but birds indistinguishable from those of Siberia occur also in southeastern Russia and the Urals, and Dementiev and Voinstvenski (cited above) use the name of the form that was described first. These last authors do not recognize *baicalensis* which differs from typical *asiatica* only by being somewhat darker above but not sufficiently, in my opinion also, to warrant its recognition. *Baicalensis* has been described again by Portenko as *partiaria* with type locality Sretensk, as he argues that the type locality of *baicalensis* is Irkutsk and not Transbaicalia. However, according to Sztolcman and Domaniewski, the type

¹ See Sztolcman and Domaniewski (1927, Ann. Zool. Mus. Hist. Nat. Polonici, vol. 6, p. 162).

of *baicalensis* was actually collected at Darasun which is only about 150 kilometers west of Sretensk, and Darasun must stand. Voous and Van Marle prefer not to use the name *baicalensis* which they state refers to a form described from a zone of intergradation between *biedermanni* [= *asiatica*] and *amurensis*. From the statements of a number of authors, some of them quoted by Voous and Van Marle, it does seem that *asiatica* and *amurensis* intergrade in Transbaikalia, but the true situation is none too clear and requires further study.

Virtually all the authors in the Far East, such as Dementiev, Voinstvenski, and the "Hand-list of the Japanese birds" (1942, p. 34), or Austin (1953, in Austin and Kuroda, Bull. Mus. Comp. Zoöl., vol. 109, p. 519) consider that *clara*, *sakhalinensis*, and *takatsukasai* are invalid and synonyms of *asiatica* (or *baicalensis* if they use this name instead of *asiatica*). It seems very unnecessary to have revived them, as Voous and Van Marle have done, as the populations described under these names differ from *asiatica* only in the most trivial characters, very slight differences in coloration which involve chiefly the color of the under parts that are relatively more or less slightly tinged with creamy.

5. *Sitta europaea amurensis* Swinhoe, 1871, type locality, Amur, with *hondoensis* Buturlin, 1916, type locality, Hondo, restricted to Shinano in the "Hand-list of the Japanese birds" (*loc. cit.*) as a synonym. *Amurensis* differs from *asiatica* by being more or less extensively and darkly washed with buffy brown on the abdomen and flanks, whereas *asiatica* is white. It averages also a little larger. A cline of increasing color saturation runs from the Amur Valley to Hondo, Shikoku, and Kyushu, to Quelpart, but *hondoensis* is scarcely darker than *amurensis*. *Roseilia* from Shikoku and Kyushu is clearly darker, however, and is a valid race as is *bedfordi* from Quelpart. The latter is very similar to *roseilia* but is still darker rufous brown on the abdomen, with a whiter throat, so that the color of its under parts contrasts more.

6. *Sitta europaea roseilia* Bonaparte, 1859, type locality, Japan, restricted to Kyushu by the List Committee of the Ornithological Society of Japan (see "Hand-list of the Japanese birds," *loc. cit.*)

7. *Sitta europaea bedfordi* Ogilvie-Grant, 1909, type locality, Quelpart Island.

8. *Sitta europaea seorsa* Portenko (1955, Trudy Zool. Inst. Akad. Nauk U.S.S.R., vol. 18, p. 497), type locality, Tymerty River, region of Hami, eastern Tian Shan. This race was based by Portenko on only two specimens which he has kindly shown to me. Two specimens seem to be an inadequate series, but they were collected in a region which is very widely isolated geographically from all other regions where the

species is known to occur. *Seorsa* is nearest to *asiatica*, but it is tinged with rosy buff on the abdomen. It may average a little larger than *asiatica*, the two specimens, both males, having a wing length of 81, 82, whereas 10 males of *asiatica* from the western end of its range measure 77–82 (79). Johansen (1952, Jour. Ornith., vol. 92, p. 173) reports that three males from the "Tian Shan" have a wing length of 80, 80, 83. The locality of these three males is not given, and it is possible that two of these are the same specimens mentioned on which *seorsa* is based.

B. THE *caesia* GROUP: The populations of this group are buffy brown on the lower throat and breast which are thus concolorous with the color of the abdomen. This group and the nominate *europaea* group are connected by many hybrid populations which have been well studied by Voous and Van Marle. These populations, which, as is to be expected, vary a great deal individually, occupy a very wide zone of secondary intergradation which extends from about southern Latvia, most of White Russia, and western Ukraine to the Danish Islands, northeastern Germany, Poland, and perhaps eastern Czechoslovakia and eastern Hungary, and most of Romania, to eastern Bulgaria. The hybrids have been described under many names, the oldest and best known of which is *homeyeri* Seebohm, 1890, type locality, East Prussia (see Hartert, 1892, Ibis, p. 364).

The geographical variation in this group is slight, except at the eastern extremity of the range in Iran where the race *persica* is well differentiated, and involves various degrees of saturation in the color of the under parts or relatively slight differences in the shade of the buffy brown which may be more or less dull, or brighter and more cinnamon. In addition, the races of Asia have, or show a tendency to have, a faint and narrow band of white at the base of the bill on the forehead, which is suggested only occasionally in the European races, but this character is slight. The bill varies in shape also and can be thicker or more slender and more or less blunt or attenuated at the tip. Its length and that of the wing vary also, but within very narrow limits, and the bill and wing measurements (see Voous and Van Marle) of all the populations overlap almost completely except in one instance in Iran (see below). Much of the variation in this group is clinal, but it is probably best not to discuss it in the terms of clines, because there is room for differences of opinion, as my material apparently does not agree on all points with that examined and arranged into clines by Voous and Van Marle. For instance, I find that two populations (Italy and Dalmatia) that they have placed in independent clines, which they believe are of

phylogenetic importance, are in fact identical. Further, I can see no apparent concordance between the various characters, not even between the relative thickness of the bill and its length. It seems to me that it is best to describe the geographical variation in general terms, as follows:

In central and southern Germany the populations are darkest, more "earthy," and have a rather stout and moderately blunt bill; they are the typical *caesia*. From my material and the accounts given by various authors, similar but slightly differentiated populations range south to the southern Balkans, northern and western Switzerland (to the Valais, but not to southern and southeastern Switzerland where my specimens from the Tessin and from Poschiavo are *cisalpina*), the Pyrenees and the Cantabrian Mountains in northern Spain, and also to England. I consider therefore that the forms *affinis* (England), *hassica* (Rhineland), *extrema* (western France), and *harrisoni* (southern Balkans) are too slightly differentiated to warrant recognition and that these names are best synonymized with *caesia*.

From Portugal and central Spain south to Morocco, the populations are very similar to *caesia* but are paler below, with darker flanks (or rather the color of the flanks contrasts more with that of the belly), and have a more slender and more attenuated bill. These are *hispaniensis* of which *atlas* (Morocco) is a synonym, as the population of Morocco differs from that of Spain only by being slightly darker below, and then only in very fresh plumage, but the difference is very trivial and not constant.

In Italy, Sicily, Dalmatia, and Bosnia the populations (*cisalpina*) are appreciably brighter below than *caesia*, more orange, less brownish buff, and their bill is similar to that of *hispaniensis*, though a little less slender. In Sicily the population averages very slightly paler than that in Italy.

I see no sound reason for recognizing any races in Europe other than *caesia*, *hispaniensis*, and *cisalpina*, and, of the three, *hispaniensis* is the least well differentiated.

In southern Asia Minor the population (*levantina*) is poorly differentiated also and very similar to *hispaniensis*. The bill is the same, but *levantina* is slightly paler below, especially on the flanks, and shows a faint band of white on the forehead, which, as stated above, is seldom shown in the other three races. The race (*persica*) of southwestern and southern Iran is an extreme *levantina* and is considerably paler, not only below but above, than any other race of the *caesia* group, and the white frontal band is well indicated. Its bill is also quite slender and attenuated. Though I refrain from discussing clines, I believe *persica*

is probably connected to *levantina* by intergrading populations in Kurdistan.

The last two valid races (*caucasica* of the Caucasus and Transcaucasia and *rubiginosa* of northern Iran) are related and are perhaps isolated from those of Europe (as they are from *levantina* and *persica*), though this is not certain, as Kummerlöwe and Niethammer (1934, Jour. Ornith., vol. 82, p. 547) state that *caucasica* is the race of northwestern Asia Minor. *Caucasica* is very similar to *cisalpina* in coloration below, but a little more ochraceous, less bright, and has a very stout and blunt bill. In *rubiginosa*, the bill is thick and blunt also but longer,¹ and the under parts are paler, but the upper parts are darker, more slaty, than in any other population of the *caesia* group.

A few more details may be added. In *caesia* the palest populations appear to be those of the French and Spanish Pyrenees and northern Spain and of the southern Balkans, and the only difference I can detect between two specimens from the Balkans, six from the Pyrenees, and four from the Cantabrian Mountains is that the bill is less attenuated in the two from the Balkans. The specimens from the Pyrenees and northern Spain suggest that *caesia* grades into *hispaniensis*, and Meinertzhagen (1947, Bull. Brit. Ornith. Club, vol. 68, p. 25) has reported intermediates from as far north as central France.

The similarity in coloration between some specimens from the Balkans and some from the Pyrenees has already been mentioned by Harrison and Pateff (1937, Ibis, p. 600). Voous and Van Marle have described the population of the southern Balkans as *harrisoni*, but I doubt that it is sufficiently well differentiated to warrant its separation from *caesia*. These authors based *harrisoni* on the material collected by Harrison and Pateff (*loc. cit.*) in 1935, and also by Harrison (1933, Ibis, p. 517) in 1932, but the fact that Harrison and Pateff, and Harrison, identified this material as *caesia* suggests that it does not differ appreciably from the latter. Stresemann (1920, Avifauna Macedonica, Munich, Dultz and Co., pp. 90-91) was unable also to detect a difference between specimens from Bavaria and a series of 19 from Macedonia, and my two specimens from the southern Balkans match the palest birds I have examined from Germany.²

I follow Meinertzhagen (*loc. cit.*) and the "Check-list of the birds of

¹ In these two races, adult males measured by me have a bill length of 22, 22, 23, 23.5 (22.6) in *rubiginosa*, and 20, 20, 20.2, 20.5 (20.2) in *caucasica*, and, respectively, 23.5 in one female and 18.5, 19.5 in two females.

² Since the above was written. I have examined much additional material from the Balkans in various European museums which has confirmed my opinion.

Great Britain and Ireland" (1952, London, British Ornithologists' Union, p. 68) in considering *affinis* to be a synonym of *caesia*, for I cannot agree with Voous and Van Marle that it is constantly separable from *caesia*. In fact, I find that when comparison is restricted to specimens in comparative plumage almost all the specimens from England, of which I have examined a large series, are identical with *caesia*, or virtually so. A very slight population trend can be discerned, however, as some specimens from England are a trifle less brownish, and on the whole the bill in English birds is a little more attenuated and more compressed laterally along its distal half, but the difference is trivial and is not constant, as stated.

Although I agree with Meinertzhagen about the lack of validity of *affinis*, I do not agree with him that *cisalpina* is a synonym of *hispaniensis*. The two appear to me to be separable by the difference in the color of the under parts.

9. *Sitta europaea caesia* Wolf, 1810, type locality, Bavaria, with the following synonyms: *affinis* Blyth, 1846, type locality, England; *hassica* Kleinschmidt, 1917, type locality, Rhineland; *hoerningi* Kleinschmidt, 1928, type locality, Thuringia; *extrema* Mayaud (1935, Arch. Suisses d'Ornith., vol. 1, p. 250) type locality, western France; and *harrisoni* Voous and Van Marle (1953, Ardea, vol. 41, suppl., p. 10), type locality, southwestern Bulgaria.

10. *Sitta europaea cisalpina* Sachtleben, 1919, type locality, Italy, near Rome, with the following synonyms: *dalmatina* Kleinschmidt, 1928, type locality, Dalmatia; and *siciliae* Kleinschmidt and von Jordans, 1932, type locality, Sicily.

11. *Sitta europaea hispaniensis* Witherby, 1913, type locality, near Madrid, Spain, with *atlas* Lynes, 1919, type locality, Middle Atlas, Morocco, as a synonym.

12. *Sitta europaea levantina* Hartert, 1905, type locality, Taurus, Asia Minor.

13. *Sitta europaea persica* Witherby, 1903, type locality, southwestern Iran.

14. *Sitta europaea caucasica* Reichenow, 1901, type locality, northern Caucasus.

15. *Sitta europaea rubiginosa* Tschusi and Zarudny, 1905, type locality, Gurgan, northern Iran.

C. THE *sinensis* GROUP: The populations in this group are buffy brown below as in the *caesia* group, or they are gray, but, when buffy brown, have the cheeks concolorous with the breast, not white as in the *caesia* group, and generally speaking are smaller birds. They are con-

nected to the nominate *europaea* group by a hybrid population which occupies a relatively narrow zone of secondday intergradation in southern Jehol in southern Manchuria, but the range of which probably extends southward a little way to neighboring extreme northern Hopeh. The hybrids were described as *kleinschmidti* by Hartert and Steinbacher in 1933, type locality, southern Jehol.

Eight subspecies have been recognized in this group by Voous and Van Marle, but it seems sufficient to me to recognize only four: *sinensis*, *montium*, *nagaensis*, and *grisiventris*. The last two are not Palearctic, as they inhabit some of the hills of Assam and Burma and the mountains of southern Annam.

The geographical variation is as follows: *Sinensis* is buffy brown below, as is *caesia*, and ranges from northern Hopeh to the Yangtze Valley, western Szechwan, Fukien, and Formosa. The population (*formosana*) of Formosa is slightly brighter below, but the difference is very slight and not sufficient in my opinion to warrant the recognition of *formosana*. *Sinensis* is chiefly a lowland bird or a bird of moderate elevations, and at the higher elevations in Fukien (and probably in other high regions of southeastern China) is replaced by *montium*. Thus two distinct races occur in Fukien, which has been a source of confusion. This situation is not unique in *europaea*, as in the Japanese Alps of Hondo the population of the lowlands (*amurensis*), which has a buffy abdomen, is replaced above 1500 meters by a white-bellied population similar to *asiatica*. The situation is complicated further by the fact that *montium* in fresh or little-worn plumage is buffy below as is *sinensis* though duller, browner, and less cinnamon. In worn and spring plumage it becomes much more grayish than *sinensis* and in all plumages can be distinguished from it, as it is darker and bluer above and less whitish below the eye and on the chin and is usually larger. *Sinensis*, however, is not uniform; it varies in size and coloration, becoming grayer below, darker above, and larger as its populations ascend from the lowlands. For instance, I have examined a series of eight specimens from the region of Cheng Wei, 25 miles west of Wenchwan in western Szechwan, which, though still closer to *sinensis* in coloration, is grayer below, darker above, and larger (see below) and is thus an intermediate between *sinensis* and *montium*. These specimens were collected between 7000 and 10,000 feet, but typical *montium* is much grayer still and lacks the whitish chin and whitish region below the eye that are typical of *sinensis* and shown in all the specimens from Cheng Wei.

I cannot separate *montium* and *nebulosa*. A cotype of *nebulosa* that

I have examined is less gray below than the cotype of *montium* mentioned, but it is considerably less worn, as it was collected on January 15, whereas the cotype of *montium* was collected on April 26. There is no difference in size. La Touche, when he described *nebulosa*, did so because of the difference in coloration mentioned and because he believed that *nebulosa* showed no seasonal change in the coloration of the plumage. He was wrong, however, as Riley (1926, Proc. U. S. Natl. Mus., vol. 70, art. 5, p. 50) and Greenway (1933, Bull. Mus. Comp. Zoöl., vol. 74, p. 157) have shown, and who are confirmed by two series that I have examined, one from Yunnan and the other from Burma. La Touche mentioned also that the bill is stouter in *nebulosa*, but this difference is not constant, and as a matter of fact the bill is virtually identical in the two cotypes. *Tibetosinensis* averages larger, and *delacouri* smaller, than *montium*, but as the differences appear to be correlated with altitude and vary in the same region (as in northeastern Burma, see below), it seems best to me not to recognize these two forms, which are acknowledged not to differ from *montium* in coloration. Deignan (1945, Bull. U. S. Natl. Mus., no. 186, p. 315) believes also that it is best to synonymize *delacouri* with *montium*.

Nagaensis and *grisiventris* are purer gray below in worn plumage than *montium* and are said to lack all traces of buffy in fresh plumage. They are quite similar, but the abdomen is darker gray in *grisiventris* and contrasts more with the color of the throat than in *nagaensis*.

The measurements given below are the wing lengths of the adult males that I have examined. A few comparative measurements are cited from the literature.

Sitta europaea sinensis: Lowlands or low elevations of eastern China, 72, 73, 73, 73, 74, 75, 76, 76, 76, 77, 77, 78.5, 79 (75.2). Tsinling Range, 78, 78. Formosa (8000 feet), 78, 79. Western Szechwan (intermediates from Cheng Wei, 7000 to 10,000 feet), 78, 78, 79, 79, 81, 82 (79.5).

Sitta europaea montium: Cotype of *montium*, 77+ (worn); cotype of *nebulosa*, 79.5. Burma, Southern Shan States, 77; Bhamo, 77, 79; Southern Shan States and northwestern Siam, 71-76 in eight males and three females, according to Deignan (1938, Jour. Washington Acad. Sci., vol. 28, pp. 371-372). Northeastern Burma (4000 to 5500 feet), 77, 78, 79, 80, 81 (79); northeastern Burma (7000 to 7500 feet), 79, 80, 81, 82, 82, 82 (81). Northwestern Yunnan (9000 to 12,000 feet), 78, 79, 80, 81, 82, 83, 83, 83, 85 (81.6). "South-eastern Tibet" [southwestern Sikang], 83-86 in 10 males, according to Kinnear (1944, Ibis, p. 71). Central and eastern Sikang, 82.5-89 in males, according to Schäfer (1939, Proc. Acad. Nat. Sci. Philadelphia, vol. 90, p. 213).

16. *Sitta europaea sinensis* Verreaux, 1871, type locality, Kiukiang,

northern Kiangsi, with *formosana* Buturlin, 1911, type locality, Formosa, as a synonym.

17. *Sitta europaea montium* La Touche, 1899, type locality, Kuantun, northwestern Fukien, with the following synonyms: *nebulosa* La Touche, 1922 (January), type locality, southeastern Yunnan; *tibetosinensis* Kleinschmidt and Weigold, 1922 (September), type locality, northwestern Yunnan; *delacouri* Deignan (1938, Jour. Washington Acad. Sci., vol. 28, p. 371), type locality, northwestern Siam; and *konyboensis* Kinnear (1940, Bull. Brit. Ornith. Club, vol. 60, p. 57), type locality, "southeastern Tibet" [= southwestern Sikang], corrected to *kongboensis* by Kinnear (1944, *ibid.*, p. 74).

18. *Sitta europaea nagaensis* Godwin-Austen, 1874, type locality, Naga Hills.

19. *Sitta europaea grisiventris* Kinnear, 1920, type locality, Mt. Victoria, Chin Hills.

D. THE *cashmirensis* "GROUP": This "group" consists of a single and well-differentiated form which differs from all forms of the first three groups by being markedly sexually dimorphic in coloration, though very much less so than the forms of the *castanea* group in which sexual dimorphism is extremely striking. It differs also from all other forms, whether *europaea* or *castanea*, by having the under tail coverts uniform in coloration, or showing at the most in some specimens a trace of grayish at the center of the feathers.

Some authors have treated *cashmirensis* as a separate species, others have thought it conspecific with *europaea*, while others have united it with the *castanea* group and considered that the latter is specifically distinct from *europaea*. Still others, including myself, have treated *cashmirensis* and *castanea* as races of *europaea*. In an earlier paper (1950, Amer. Mus. Novitates, no. 1472, pp. 4-9) I stated that *cashmirensis* represents the link that connects *europaea* and *castanea*, a view already held by Kleinschmidt (1928, Berajah, p. 14.) There is no question that to some extent *cashmirensis* is intermediate between *castanea* and *europaea*, but it is closer to the latter, and I believe now that Voous and Van Marle are correct when they question that it is as closely related to *castanea* as some authors believe. *Castanea* was probably derived, together with *cashmirensis*, from some *europaea*-like ancestor, but whether or not *castanea* is still conspecific is an open question. I may add that tape recordings that I have heard through the courtesy of Dr. Löhrl show striking dissimilarities between the call notes and other utterances of *castanea* and those of the European nuthatch. For a discussion of the relationship of all three to one an-

other and to *S. himalayensis*, see the instructive discussion of Voous and Van Marle. Reservation must be made, as mentioned in my introductory remarks, however, that *castanea* and *europaea* do not come into contact in the eastern Himalayas, and I strongly question also whether the two rock nuthatches are as closely related to *cashmirensis* and *europaea* as these authors believe.

20. *Sitta europaea cashmirensis* Brooks, 1871, type locality, Kashmir, with *hariabica* Whistler (1944, Jour. Bombay Nat. Hist. Soc., vol. 44, p. 516, ex Wardlaw-Ramsay MS), type locality, Byan Khel, southern slopes of the Safed Koh on the border of Afghanistan and North West Frontier Province, as a synonym.

Whistler inadvertently became the author of *hariabica* when he mentioned that a specimen from Afghanistan labeled *hariabica* by Wardlaw-Ramsay differs from *cashmirensis* by having a stronger and longer bill. This difference was shown also by two specimens from neighboring northern Baluchistan examined by Whistler, and it is shown also by four specimens that I have examined from Afghanistan. It is very probable therefore that the populations of Afghanistan and Baluchistan differ from the population of Kashmir, but it seems best not to recognize *hariabica*, as the difference is relatively slight and, as in the case of Whistler, I lack sufficient comparative material to decide whether or not it is constant.

E. THE *castanea* GROUP: The most important morphological character of this group, its very striking sexual dimorphism, is mentioned above. As this group is not Palearctic, it is not discussed here and its valid races are merely listed, but I may add that the populations from the eastern part of its range require further study. The populations of India are better known and were discussed in my 1950 paper cited above. I have shown in that paper that *prateri*, recognized by Voous and Van Marle, does not appear to be separable from *castanea*.

The validity of the race *koelzi* described by me in 1950 from the Patkai Hills has been questioned by Voous and Van Marle, but they lacked specimens from its range. Deignan, who borrowed my material in 1954, confirmed (*in litt.*) that *koelzi* is valid and differs from *cinnamouentris* by being darker below, as stated in the description. He adds that it differs also by having darker, almost black, bases to the under tail coverts (a character that had escaped me) and in this respect is similar to *tonkinensis*. Specimens of *tonkinensis* were not available to me in 1950 and are not now, but Deignan states that *tonkinensis* is "decidedly" paler below than *koelzi*. These differences are shown only in females, as males of *koelzi* and *cinnamouentris* are indistinguishable.

21. *Sitta europaea castanea* Lesson, 1830, type locality, Bengal, with *prateri* Whistler and Kinnear (1932, Jour. Bombay Nat. Hist. Soc., vol. 35, p. 522), type locality, Vizagapatam district, upper Eastern Ghats, as a synonym.

22. *Sitta europaea almorae* Kinnear and Whistler, 1930, type locality, Almora district.

23. *Sitta europaea cinnamoventris* Blyth, 1842, type locality, Darjeeling.

24. *Sitta europaea koelzi* Vaurie, 1950 (*loc. cit.*), type locality, Patkai Hills, Assam.

25. *Sitta europaea tonkinensis* Kinnear (1936, Bull. Brit. Ornith. Club, vol. 56, p. 71), type locality, Napé, Laos.

26. *Sitta europaea neglecta* Walden, 1870, type locality, Karen Hills, Burma.

Sitta canadensis, *Sitta krüpperi*, and *Sitta yunnanensis*

These three small nuthatches are often considered to be conspecific but in my opinion are separate species.¹ They replace one another geographically: *krüpperi* in Asia Minor and the Caucasus, *yunnanensis* in Sikang and Yunnan, and *canadensis* in North America, Corsica, and western and northern China to central Manchuria and Korea. This distribution suggests that we are dealing possibly with a once very widely spread species and that the present-day populations are relicts, but analysis of their morphological characters (table 1) strongly suggests that *krüpperi*, *yunnanensis*, and *canadensis* are not conspecific.

The three species are probably not even closely related. *Yunnanensis* does not have a black cap in either sex, and I suspect that its nearest relative is *himalayensis*. The phylogenetic significance of the color of the crown is not clear, but its color pattern appears to be a very conservative character as, generally speaking, all nuthatches can be divided into two groups, one in which the color of the crown contrasts with that of the back and the other in which the crown and back are concolorous. In *yunnanensis* the crown and back are blue-gray and identical.

Krüpperi differs from *yunnanensis* and *canadensis* through several im-

¹ Nomenclature: *canadensis* Linnaeus, 1766, Canada; *krüpperi* Pelzeln, 1863, Smyrna; *yunnanensis* Ogilvie-Grant, 1900, Yunnan; *whiteheadi* Sharpe, 1884, Corsica; *villosa* Verreaux, 1865, China north of Peking; *corea* Ogilvie-Grant, 1906, central Korea; and *bangsi* Stresemann, 1929, northeastern Tsinghai. The last two forms are only very slightly differentiated populations of *villosa* and are ignored in the present discussion of relationships.

TABLE 1

COMPARISON OF THE MORPHOLOGICAL CHARACTERS OF ADULTS IN *Sitta canadensis*,
S. whiteheadi, *S. villosa*, *S. yunnanensis*, AND *S. krüperi*^a

Form	Color of Cap ^b	Stripes on Head ^c	Color of Under Parts ^d	Wing ^e Length	Tail ^e Index
<i>canadensis</i>	Dimorphic	Superciliary very prominent. Facial stripe very prominent	Strongly rufous, slightly dimorphic	68	53
<i>villosa</i>	Dimorphic	Superciliary prominent. Facial stripe obsolete	Pale ochraceous buff	70	53
<i>whiteheadi</i>	Dimorphic	As in <i>villosa</i>	Dingy grayish white with a slight suggestion of buff in some specimens	72	54
<i>yunnanensis</i>	Not dimorphic (gray)	Superciliary virtually obsolete. Facial stripe most prominent	Creamy gray	72	51
<i>krüperi</i>	Not dimorphic (black)	Superciliary virtually obsolete. Facial stripe obsolete	Conspicuous band of chestnut across the upper breast, abdomen gray. Slightly dimorphic	74	47

^a The first three forms are believed to be conspecific, the last two separate species (see text).

^b In forms that are sexually dimorphic, the cap is black in males and slaty or gray in females. In *yunnanensis* the crown is gray in both sexes and concolorous with the back. In *krüperi* the anterior part of the crown is black in both sexes, and the hind part of the crown is concolorous with the back.

^c Superciliary stripe is white; facial stripe is black, blue-black, or dusky black and more or less invaded by whitish feathers when obsolete.

^d In *canadensis*, females are a little duller; in *krüperi*, females are slightly darker gray on abdomen and faintly tinged with ochre on lower flanks.

^e In round numbers; for measurements, see table 2.

portant characters. It has a black crown, but it is not sexually dimorphic as is *canadensis*, and the pattern of the black area is different. In *krüperi* the black area is restricted to the front of the crown, or does not extend beyond its center, and is sharply delimited posteriorly, whereas in all other nuthatches that are black on the crown, the black area reaches the hind neck or invades the upper mantle and is less sharply delimited. Only one other nuthatch (*frontalis* of India and Burma) has the black area restricted to the front of the crown, but the band is narrower, and it is obvious that *frontalis*, which is a very colorful species, is related not to *krüperi* but (probably) to the equally or even more colorful *azurea* and *formosa*. *Krüperi* differs also from all the other nuthatches by having a very conspicuous band of chestnut across the upper breast, whereas in all the other species that are rufous or chestnut below these pigments extend over the whole abdomen. In *krüperi* the abdomen is gray. The proportions of *krüperi* are also somewhat different.

The extremely disjunct distribution of the remaining forms raises the question of whether or not the populations of Corsica (*whiteheadi*) and China (*villosa*) are conspecific with each other and with the population of North America (*canadensis*). It is obvious that these three forms present certain morphological similarities, and it has been long believed that they have common affinities. It is not certain, however, that they are conspecific, but speculations based on present-day distribution or a mere analysis of morphological characters are not conclusive, and, everything considered, it seems best at present to treat *whiteheadi*, *villosa*, and *canadensis* as conspecific. Comparison of the birds in life may throw some light on this question, and Hans Löhrl is now engaged in a comparative study of *whiteheadi* and *canadensis* in the field. We may recall that it was only through comparison of the birds in life that the long-debated question as to whether or not *Parus atricapillus* of the New World and *P. montanus* of the Old were separate species was decided in the affirmative.¹

Some species of nuthatches reduce the size of the entrance hole to their nest by plastering it up with mud or clay, while others do not, and this habit is believed by some authors to be a good clue to relation-

¹ After these notes were written, I had the pleasure to meet Dr. Löhrl and Professor Stresemann in Germany. Löhrl had just returned from the United States where he had studied *canadensis* in the field, and he told me, though his studies are not completed, that present evidence strongly suggests that *whiteheadi* and *canadensis* are separate species. Stresemann agreed and told me that, in his opinion, *villosa* is also a separate species.

ships. *Whiteheadi* does not narrow the entrance to its hole according to Whitehead (1885, *Ibis*, p. 31), nor does *krüperi* according to Hartert and Steinbacher (1933, *Die Vögel der paläarktischen Fauna*, suppl. vol., p. 172) who consider that these forms are conspecific with *canadensis* and emphasize this habit as a clue to their relationship. However, although *canadensis* does not use mud or clay, it shows a tendency to narrow the entrance to its hole with pitch instead of mud or clay. This is mentioned by Tyler (1948, in Bent, *Life histories of North American birds*, Bull. U. S. Natl. Mus., no. 195, p. 24) who states, "It is an apparently invariable habit of the red-breasted nuthatch to smear with pitch the entrance of its nesting cavity." The habit is well ingrained, and the bird does this even when using bird boxes instead of natural cavities or holes it excavates. I have not been able to find information on *yunnanensis* and *villosa*.

One may question, however, whether this habit is a valid clue to relationship, as it is common to some species that obviously are not closely related, such as *europaea* and *frontalis*, and even in some species that usually narrow the entrance, some individuals do not follow this practice.

Sitta himalayensis

The White-tailed Nuthatch ranges from northern Punjab in the Himalayas eastward to Assam, including the hills south of the Brahmaputra from the Naga Hills down to Manipur and the Lushai Hills, Burma and neighboring northwestern Yunnan, northwestern Tonkin, and the Tranninh in upper Laos. It recurs also on Mt. Victoria in the Chin Hills from whence a very distinct form (*victoriae* Rippon, 1904) has been described. This form, which is discussed by Stresemann (1940, *Mitt. Zool. Mus. Berlin*, vol. 24, pp. 176-177) may be a separate species. It differs from the other populations by being white rather than rufous on the breast and center of the abdomen, by having a white rather than black band on the forehead at the base of the bill, by having a somewhat different pattern on the central tail feathers, and also by having a very much smaller bill.

All the other populations differ only very slightly, and it seems best to recognize only one race for them, nominate *himalayensis* Jardine and Selby, 1835, type locality, Himalayas, restricted to Simla by Meinertzhagen (1927, *Ibis*, p. 410), that is, if we assume that *victoriae* is conspecific. In this connection, it may be mentioned that in Mayr's paper on the birds of Burma (1941, *Ibis*, p. 56) the then editor of the *Ibis* (Ticehurst) appended a footnote stating that the collection of the

TABLE 2
MEASUREMENTS OF THE FORMS OF *Sitta* COMPARED IN TABLE 1

Form	N	Wing Length	Tail Length	Wing/Tail Index ^a
<i>canadensis</i>	10♂ ¹	67-71 (68.8)	36-39 (36.8)	53.5
	10♀	65-70 (67.0)	33-37 (34.8)	52.0
<i>villosa</i>	4♂ ^b	70-74 (72.0)	38-40 (39.0)	54.0
	2♀ ^b	70,71	37, 37	52.5
	2♂ ^c	66,69 (67.5)	31, 35 (33.0)	49.0
	1♀ ^c	68.5	37.0	54.0
<i>whiteheadi</i>	4♂ ¹	71-75 (72.5)	38-41 (39.0)	54.0
	3♀	70-72 (71.0)	37-40 (38.4)	54.0
<i>yunnanensis</i>	10 ^d	69-75 (72.0)	31-40 (36.8)	51.0
<i>krüperi</i>	3♂ ¹	74-77 (75.7)	33-37 (35.3)	46.5
	5♀	72-74 (72.6)	33-36 (34.5)	47.5

^a Proportion of the length of the tail to that of the wing expressed in per cent.

^b From Kansu and Tsinghai (*bangsi*).

^c From northern Hopeh (*villosa*).

^d Adults of both sexes.

British Museum contains specimens of both forms collected at "about the same time in April" at the same elevation on Mt. Victoria. It is possible, however, that the specimens of nominate *himalayensis* might have been visitors or stragglers as, so far, only *victoriae* is known to breed on Mt. Victoria. Until we have definite proof that the two forms breed side by side, it seems best to follow Meinertzhagen and Mayr in considering them to be geographically representative and conspecific, as there is no doubt whatever that they are very closely related.

Three other forms have been described, but they do not differ sufficiently from nominate *himalayensis* to warrant being recognized. They are: *whistleri* Delacour, 1932, type locality, northwestern Tonkin; *australis* Koelz (1951, Jour. Zool. Soc. India, vol. 3, no. 1, p. 29), type locality, Tekhubama, Naga Hills, Assam; and *lushaiensis* Koelz (1952, Jour. Zool. Soc. India, vol. 4, no. 1, p. 37), type locality, Hmuntha, Lushai Hills, Assam.

A cline of decreasing size in the length of the wing and bill runs from the Himalayas through Burma and Yunnan to Indochina, and *whistleri* shows also a tendency to be somewhat brighter rufous below, but this difference is very slight and not constant. In view also of the fact that the cline in measurements is not sharp and the populations

of Burma and Yunnan are about intermediate, I agree with Mayr (*loc. cit.*) that it is wiser not to recognize *whistleri*.

A cline of increasing saturation in the color of the under parts probably runs from the Himalayas southward to the Naga Hills and Manipur and may be reversed slightly in the Lushai Hills at the southern end of the range. However, the difference between specimens that I have compared from the Himalayas on the one hand and ones from the Naga Hills and Manipur on the other is very slight only. It is also far from constant, as I can match perfectly about a third of the paratypes of *australis*, collected in 1950, with specimens in comparative plumage collected in the western Himalayas in 1948 and 1953. The other supposed differences mentioned by Koelz (shorter postocular streak and bill stouter than in nominate *himalayensis*) vary individually to the same extent shown by the birds of the Himalayas. As *australis* does not differ in size (see below), it is therefore even more poorly differentiated than is *whistleri*.

Lushaiensis was described as "similar to *australis* of Naga Hills but paler below." This difference is present in the specimens collected by Koelz in the Lushai Hills, but he failed to mention that virtually all his specimens are in very badly worn plumage, whereas the series of *australis* to which he compared them is in extremely fresh plumage. The latter had just completed the molt, and some still show a few traces of it. Under the circumstances, and in view of the fact that the specimens of *lushaiensis* which are the least worn are identical with specimens from the Himalayas showing the same degree of wear, I believe that *lushaiensis* requires confirmation by specimens in better plumage.

It would have been of interest if *lushaiensis* had been intermediate in characters between nominate *himalayensis* and *victoriae*, thereby showing that the latter is not so isolated as it is believed to be. However, with the exception of a possible tendency towards paler under parts which requires confirmation, the birds that I have examined from the Lushai Hills are not intermediate. Their bill is identical in shape and size with that of the birds of the Himalayas, and they are identical also in the color of the forehead and central tail feathers. The series examined includes seven from Blue Mountain which is only 180 kilometers to the north of Mt. Victoria.

The populations of Assam and of the Himalayas are about the same size, while those of Indochina and Mt. Victoria are slightly smaller. The measurements, as shown by the wing length of adult males, are: 71-77 (75) in 15 from the Himalayas, 70-78 (74.2) in seven from the

Naga Hills, 70-74 (72.8) in five worn ones from the Lushai Hills, 70.5, 71 in two from Tonkin, and 69, 70, 70 in three from Mt. Victoria.

I would like to express my appreciation here again to Dr. Robert W. Storer for lending the specimens collected by Koelz on which Koelz based *australis* and *lushaiensis*.

Sitta neumayer and *Sitta tephronota*

The two rock nuthatches have been discussed by me in two earlier papers (1950, Amer. Mus. Novitates, no. 1472, pp. 13-29; and 1951, Proc. Tenth Internatl. Ornith. Congr., pp. 163-166). The geographical variation was discussed in detail in the first paper, and the striking character displacement in both papers. The character displacement in these two birds has attracted considerable attention in the recent literature and elsewhere, and the significance of such displacement as a major factor in speciation has been discussed by Brown and Wilson (1956, Systematic zoology, vol. 5, pp. 49-64) in a stimulating paper.